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**Clean Harbors Services, Inc.  
11800 S. Stony Island Ave.  
Chicago, IL 60617**

**EPA ID No. ILD000608471**

**RCRA Part B License  
Request for Permit  
April 19, 2003**

**Volume 2a  
Section E**

**POST-CLOSURE GROUNDWATER MONITORING PLAN**

**FOR**

**CWM CHEMICAL SERVICES, INC.**

**CHICAGO INCINERATOR FACILITY**

**SURFACE IMPOUNDMENTS**

**Prepared by SEC/Donohue**

**OCTOBER 1991**

**Revision 1: 3/16/92**

**Revision 2: 7/16/92**

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## 1.0 PURPOSE

Chemical Waste Management Chemical Services, Inc. (CWMCS) operated four (4) surface impoundments under interim status, pursuant to 35 IAC 725 Subpart G. These surface impoundments were taken out of service on November 7, 1988. Pursuant to 35 IAC 725.328(b), these surface impoundments will be closed as RCRA land disposal units and subsequently require at least 30 years of post-closure groundwater monitoring. This document will describe a compliance monitoring program for the closed surface impoundments. 35 IAC 703.185(g) states that "if the presence of hazardous constituents has been detected in the groundwater at the point of compliance at the time of the permit application, the owner or operator shall submit sufficient information, supporting data and analysis to establish a compliance monitoring program which meets the requirements of 35 IAC 724.199. Except as provided in 35 IAC 724.198(g)(5), the owner or operator shall also submit an engineering feasibility plan for a corrective action program necessary to meet the requirements of 35 IAC 724.200, unless the owner or operator obtains written authorization in advance from the Agency to submit a proposed permit schedule for submittal of such a plan".

This document describes the Post-closure Groundwater Compliance Monitoring Program for the surface impoundments, which is built upon aspects of the previous Interim Status Groundwater Monitoring Program and information gathered through hydrogeological studies conducted at the Facility over the years. This plan is being developed in accordance with the Illinois Administrative Code (IAC) Title 35 Section 724 Subpart F. This revision includes information requested by the IEPA during a meeting on January 31, 1992 with CWMCS and SEC/Donohue

personnel and information requested by the IEPA in a June 14, 1992 letter regarding the Surface Impoundment Interim Status Closure Plan. The groundwater monitoring system described herein will replace the program designed to meet the requirements of 35 IAC Section 725 Subpart F and the State groundwater monitoring well program. The revised monitoring plan has been developed in coordination with the Illinois Environmental Protection Agency (IEPA). Upon approval, this compliance groundwater monitoring plan will be implemented as part of the post-closure care plan for the surface impoundments and will monitor the groundwater to determine whether the surface impoundments are in compliance with the specific groundwater protection standards promulgated in 35 IAC Part 620 and consistent with 35 IAC 724.194, and interim status groundwater monitoring will be discontinued.

#### 1.1 Facility History Concerning Groundwater Monitoring for the Surface Impoundments

In 1982, a series of four groundwater monitoring wells (G110, G111A, G112B, and G113A) were installed around the surface impoundments pursuant to State Permit No. 1981-46-OP-EXP. During 1983, four quarterly samples were taken to obtain background water quality data from the monitoring wells. In February 1984, the first post-background sampling of the groundwater monitoring wells indicated a statistically significant change in pH had occurred in all of the groundwater monitoring wells (G110, G111A, G112B and G113A). It also appeared that a statistically significant increase in specific conductance had occurred in groundwater monitoring well G111A. As a result of these changes (as determined by the Cochran's approximation to the Behrens-Fisher (CABF) Student's "t" Test), a groundwater assessment program was initiated in July

1984. The results of that groundwater assessment are summarized in Golder (1986b), and the results of three related investigations providing additional data for the groundwater assessment are presented in a 1985 study by P.E. LaMoreaux and Associates (PELA), Hydro-Search, Inc. (1985) and Golder (1986a). See Section 1.2 of this plan for more specific information regarding these referenced reports.

This first groundwater assessment involved the construction of several new groundwater monitoring wells to provide additional monitoring data. A detailed evaluation of historical groundwater geochemistry data and information on hazardous waste constituents accepted at the facility revealed that hazardous waste constituents had not migrated from the surface impoundments. Instead, the first groundwater assessment revealed that the quality of groundwater at the site had been impacted by the heterogeneous nature of the fill materials, historical site usage by previous owners, and upgradient and off-site sources of the constituents at issue.

The first groundwater assessment concluded that the surface impoundments had not impacted groundwater quality. Therefore, in 1986, upon completion of the first groundwater assessment, the site re-entered the detection monitoring phase of 35 IAC 725. However, following one quarter of detection monitoring, the facility determined statistically significant changes in both pH and specific conductance (based on CABF Student's "t" Test) had occurred.

During a meeting with the IEPA and the USEPA on October 20, 1986, SCA Chemical Services, Inc. (now CWMCS) and Chemical Waste Management, Inc. were advised by the agencies that the site must undertake a second groundwater assessment program to determine whether or not the surface impoundments were in fact impacting the groundwater quality.

SCA Chemical Services, Inc. (SCA) prepared and submitted a groundwater assessment plan outlining the proposed methodology which would be followed to conduct this second groundwater assessment. Negotiations were conducted with the IEPA to discuss and revise the contents of the plan, including the constituents to be analyzed in the groundwater assessment. The groundwater assessment plan was approved by IEPA on May 21, 1987 and was subsequently undertaken by Golder Associates with results provided to the IEPA in an August 1987 report entitled, "Ground-Water Assessment Report". This second groundwater assessment reaffirmed the conclusions of the first groundwater assessment that the surface impoundments were not the source of hazardous constituents that were detected in samples from the perimeter surface impoundment groundwater monitoring wells. Rather, upgradient sources, historical site usage, and the variable and heterogeneous nature of the fill materials used to construct the pier are the source of hazardous constituents detected in samples from those groundwater monitoring wells.

Upon completion of the second groundwater assessment on January 7, 1988 SCA proposed to IEPA that the facility continue in a groundwater assessment monitoring program. IEPA agreed to this approach in a February 11, 1988 letter to SCA. Additional correspondence between IEPA and SCA detailed the sampling locations, schedule and analytical parameters to be used for the continuing groundwater assessment program, with final documentation occurring in a March 25, 1988 letter from IEPA to SCA. Since that time, CWMCS has continued the interim status groundwater monitoring program for groundwater monitoring wells G120S, G121S, G123S and G124S. A modification to the continuing groundwater assessment program was made during a September 26, 1990 meeting between CWMCS and IEPA. Monitoring well G307, installed in 1989 for the RCRA Facility Investigation, was added as a second upgradient groundwater monitoring well. This groundwater monitoring well was added to the program to measure groundwater quality from the area upgradient of the surface impoundments which has not been affected by the "facility". Each quarterly groundwater assessment report has reaffirmed the conclusion that the surface impoundments are not the source of any organic or inorganic constituents detected in samples from the groundwater monitoring wells.

On May 6, 1988 Dames and Moore submitted a RCRA Facility Investigation (RFI) Work Plan to the USEPA, as required by a March 16, 1988 Consent Judgment between SCA and the USEPA. The RFI was designed to study historical releases of hazardous waste constituents to the environment from previously existing solid waste management units.

Work was initiated pursuant to USEPA approval of the work plan on August 10, 1989. Phase I of the RFI was completed in 1990 and has been used to develop the work plan and scope of work to identify additional areas of concern/evaluation to be examined in Phase II. Phase II was initiated in September 1991 and is to be completed in August 1992.

Phase I data from the RFI confirm that prior activities at the site, including fill placement by previous owners and operators, are the likely source of any constituents found in groundwater monitoring well samples, both upgradient and downgradient of the surface impoundments. An Illinois State Water Survey study prepared for the Illinois Environmental Protection Agency, dated 1990, concluded that there was no apparent release of hazardous waste or hazardous waste constituents from surface impoundments on the site. Phase II of the RFI should provide additional data to further confirm sources of constituents found in samples from the groundwater monitoring wells. A complete summary of the RCRA Facility Investigation (RFI) is contained in Section L of the Part B Permit Application.

On July 1, 1991, CWM Chemical Services, Inc. (CWMCS) entered into a Second Amended Interim Consent Decree with the People of the State of Illinois. Section IV (B.)(12) of this Consent Decree required Groundwater Monitoring Enhancements to be conducted by CWMCS.

In accordance with the Consent Decree, CWMCS met with representatives of the IEPA on July 29, 1991 to discuss the Groundwater Monitoring Enhancements and on August 27, 1991, CWMCS submitted the Groundwater Monitoring Enhancements Work Plan to the IEPA. The Work Plan detailed the tasks to be undertaken by CWMCS as agreed to by the IEPA at the July 29, 1991 meeting. One additional PVC groundwater monitoring well was to be installed, two Hydropunch groundwater samples were to be collected and Lake Calumet water levels were to be obtained.

On September 26, 1991 CWMCS received IEPA's comments on the Work Plan, and on October 24, 1991 CWMCS submitted a revised Work Plan to the IEPA in response to the Agency's comments. CWMCS agreed to construct the new monitoring well of 316 stainless steel and to obtain three Hydropunch groundwater samples versus the two originally proposed. Appendix I analytical data on the current Assessment wells was referenced to the RFI Phase I Report.

On November 6, 1991 CWMCS provided clarification to the IEPA on the need for further action after review of the Hydropunch results. This clarification was discussed by CWMCS and the IEPA on November 1, 1991. The following statement was added to the Groundwater Monitoring Enhancements Work Plan:

"If the data demonstrates the need for an additional monitoring well, CWM-CS will install the additional monitoring well in a location to be agreed upon by CWM and IEPA."



On December 4, 1991 the IEPA approved the Groundwater Monitoring Enhancements Work Plan as revised on October 24, 1991 and November 6, 1991. Field activities for the Work Plan commenced on December 19, 1991.

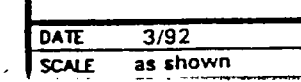
The results of the laboratory analyses were submitted to the IEPA in April, 1992 as part of the quarterly reporting requirements. As of the date of this Closure Plan, CWMCS has not received any response from the IEPA on these results and therefore, continues to monitor for those constituents and at those wells agreed to previously by CWM and IEPA. Upon completion of the IEPA's review of the results, CWMCS will meet with the Agency to determine if the data demonstrates the need for an additional monitoring well in a location agreed to by CWM and IEPA.

On December 19 and 20, 1991 SEC Donohue installed the additional downgradient groundwater monitoring well (G126S) required by the Groundwater Monitoring Enhancements Work Plan. On January 2 and 3, 1992 SEC Donohue installed the three required, temporary monitoring wells to allow for one round of groundwater samples. These temporary monitoring wells were designated as HP0192, HP0292 and HP0392 and were placed to a depth of 14.5 feet below the ground surface. These monitoring wells were sampled by Gulf Coast Laboratories, Inc. on January 3, 1992. These temporary monitoring wells were then decommissioned and sealed with bentonite grout. Appendix 7 contains the report documenting these activities.

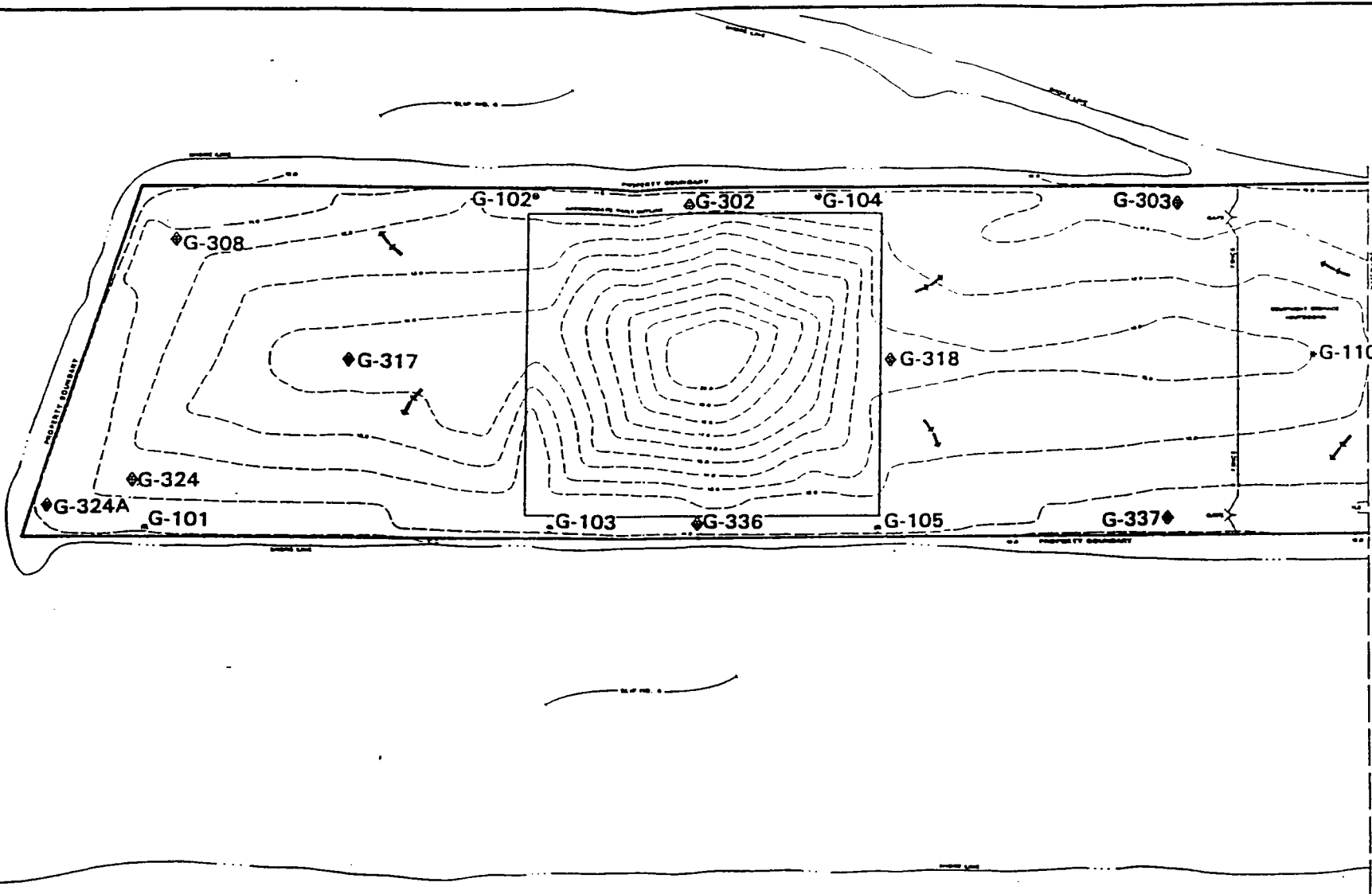
Preliminary data suggests the presence of organics and inorganics. The analytical results for G123S, the upgradient monitoring well for these surface impoundments, indicate the presence of benzene and other organics at significantly higher concentrations than that found at the point of compliance in downgradient monitoring wells. Furthermore, observations of fill material samples indicated unknown deposits (G121S-black ooze) which were logged during drilling activities. Analytical results indicated that this "black ooze" was organic in nature. These observations, coupled with historical knowledge and analytical data of the fill materials, suggests potential background interference.

The apparent but isolated levels of inorganics (i.e. fluoride, chloride) do not exceed the standards promulgated in 35 IAC 620 and they appear to correlate with the process water previously contained in the surface impoundments. These constituents are similar to the inorganic salts which were known to have been released from process water piping breaks during prior operations, and may in fact have come from releases from the pipe breaks.

Preliminary depictions of the reported organic and inorganic concentrations are shown on Figures 1-1A and 1-1B. The actual constituents of the inorganic plume from G121S and their concentrations were provided to the IEPA in the quarterly groundwater assessment report in April 1992.



LAKE CALUMET



IES.

Contour interval - 1 foot




Elevations shown on this drawing are based upon Chicago city datum

To convert to mean sea level datum add 579.88 feet to the elevations shown

All facilities shown are existing as of March 1988 unless otherwise indicated

100-year flood plain does not extend beyond limits of Lake Calumet in vicinity of facility

# LEGEND:

-  DIRECTION OF SURFACE WATER DRAINAGE
-  G-103 MONITORING WELLS INSTALLED IN 1981
-  G-110 RCRA MONITORING WELL INSTALLED IN 1981

## PHASE I INVESTIGATION - LEGEND:

SCALE 1"=100'

**SEC DONOHUE**  
Oak Brook, IL

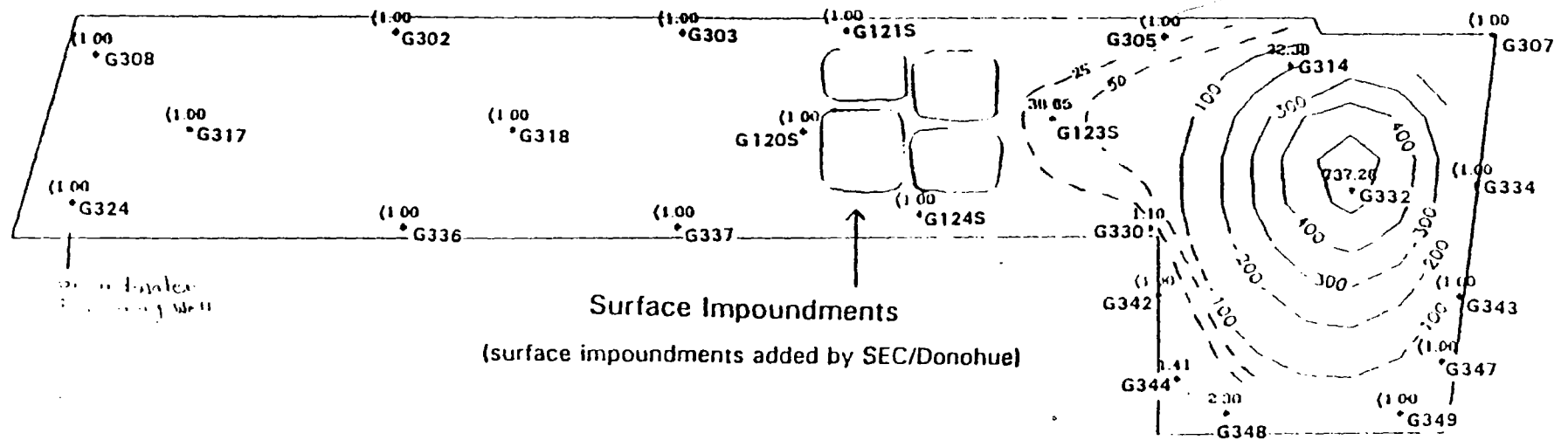
DATE 3/92  
SCALE as shown

PROJECT CWM Chemical Services, Inc.  
Chicago Incinerator

TITLE Location of Inorganic  
Constituents

FIGURE Figure 1-1A con

# LOCATION OF ORGANIC CONSTITUENTS IN GROUNDWATER (mg/L)



<b>SEC DONOHUE</b> Oak Brook, IL	PROJECT CWM Chemical Services, Inc. Chicago Incinerator
	TITLE Location of Organic Constituents
DATE 3/92 SCALE none	FIGURE Figure 1-1B

Phase II of the RFI is currently being conducted and the surface impoundments monitoring well system is currently in a groundwater assessment monitoring program.

## 1.2 History of Previous Site Investigations

The following is a chronological listing and brief summary of previous geotechnical and hydrogeologic investigations that have been carried out at and in the vicinity of the CWMCS facility:

1. A geotechnical exploration program in 1976 for the Paxton Landfill (one of the municipal landfills across Stony Island Avenue from the facility) by Walter H. Flood & Company, Inc. which included drilling of four 70-foot deep boreholes.
2. An investigation by Soil Testing Services, Inc. (in conjunction with Andrews Engineering) in 1980 which included drilling of three 32-foot deep boreholes at unknown locations for the previous Hyon Incinerator facilities on the pier.
3. A geotechnical investigation by Salisbury Engineering, Inc., in 1980 during which eight borings, ranging in depth from 30 to 60 feet, were drilled in the CWMCS Incinerator process area.
4. A series of groundwater monitoring well installation projects in 1981 and 1982 by Testing Service Corporation (TSC) during which groundwater monitoring wells G101 to G105 and G110 to G118 (and any replacements, designated by the letters A and B, for the original groundwater monitoring wells when the McTigue (automatic) samplers installed in them failed to perform satisfactorily) were

installed along the pier and on the perimeter of the CWMCS incinerator process area.

5. A geotechnical investigation by TSC in 1983 which involved another eight borings in the incineration process area.
6. A geotechnical exploration program in 1984 during which five boreholes were drilled and five piezometers (the TF-series) were installed in one of the previous bio-bed areas.
7. A hydrologic investigation by Woodward-Clyde Consultants in 1985 during which hydraulic conductivity tests were conducted in groundwater monitoring wells G111A and G112B, and a hydrographic survey (including installation of staff gauges in Slips 6 and 8) was made.
8. A 1985 study by P.E. LaMoreaux & Associates (PELA) in which data from the first groundwater assessment program were analyzed.
9. A 1985 surface electromagnetic survey by Hydro-Search, Inc. which attempted to identify the extent of process water which had leaked from the buried pipeline that previously carried process water from the Incinerator to the surface impoundments. This pipeline ran south to north, immediately east of the surface impoundments. Results of the survey were interpreted primarily by comparison to existing water quality data, and likely areas of high conductivity groundwater were delineated.
10. A review by Golder (1986a) of all currently available hydrogeologic data. The purpose of the review was to provide a "third party" evaluation of the

hydrogeologic characterization of the site that had been done to date and to provide recommendations for any necessary modifications to the existing groundwater monitoring program.

11. A groundwater assessment program/investigation by Golder (1987) to determine whether or not the surface impoundments were impacting the groundwater quality. Additional groundwater monitoring wells were installed, and results indicated that the surface impoundments were not the source of the groundwater contamination at the facility, but that upgradient conditions, historical site usage by previous owners, and the variable and heterogeneous nature of the fill materials used to originally construct the pier had caused a substantial impact.
12. A RCRA Facility Investigation (RFI), designed as two phases (I and II) to study historical releases of hazardous waste constituents to the environment from the solid waste management units at the CWMCS facility. Phase I, completed by Dames and Moore (1990) will be used to identify additional areas to be examined during Phase II.
13. In addition, the State of Illinois conducted several studies, either directly or indirectly, which have focused on groundwater quality in the Lake Calumet area of southeast Chicago. The most recent study by the Illinois State Water Survey for the Illinois Environmental Protection Agency was dated September 1990 and entitled "Groundwater Quality Investigation and Monitoring Program Design For The Lake Calumet Area of Southeast Chicago". This report presents results from a preliminary groundwater assessment of groundwater quality in the area with a



specific discussion and appraisal of the CWMCS Incinerator site surface impoundments. This report concluded that there was no apparent release of hazardous waste or constituents from surface impoundments on the site. Contamination of groundwater from upgradient off-site sources was also documented in this report. Phase II of the RFI should provide additional data to further confirm contamination sources.

14. On December 19 and 20, 1991 as part of the Groundwater Monitoring Enhancements Work Plan required of the July 1, 1992 Interim Consent Decree (ICD) Section IV.B.10, a groundwater monitoring well (G126S) was installed near the surface impoundments.
15. On January 2-3, 1992 three temporary monitoring wells were installed near G121S and the groundwater was sampled in an effort to determine the extent and concentrations of constituents downgradient from G121S.

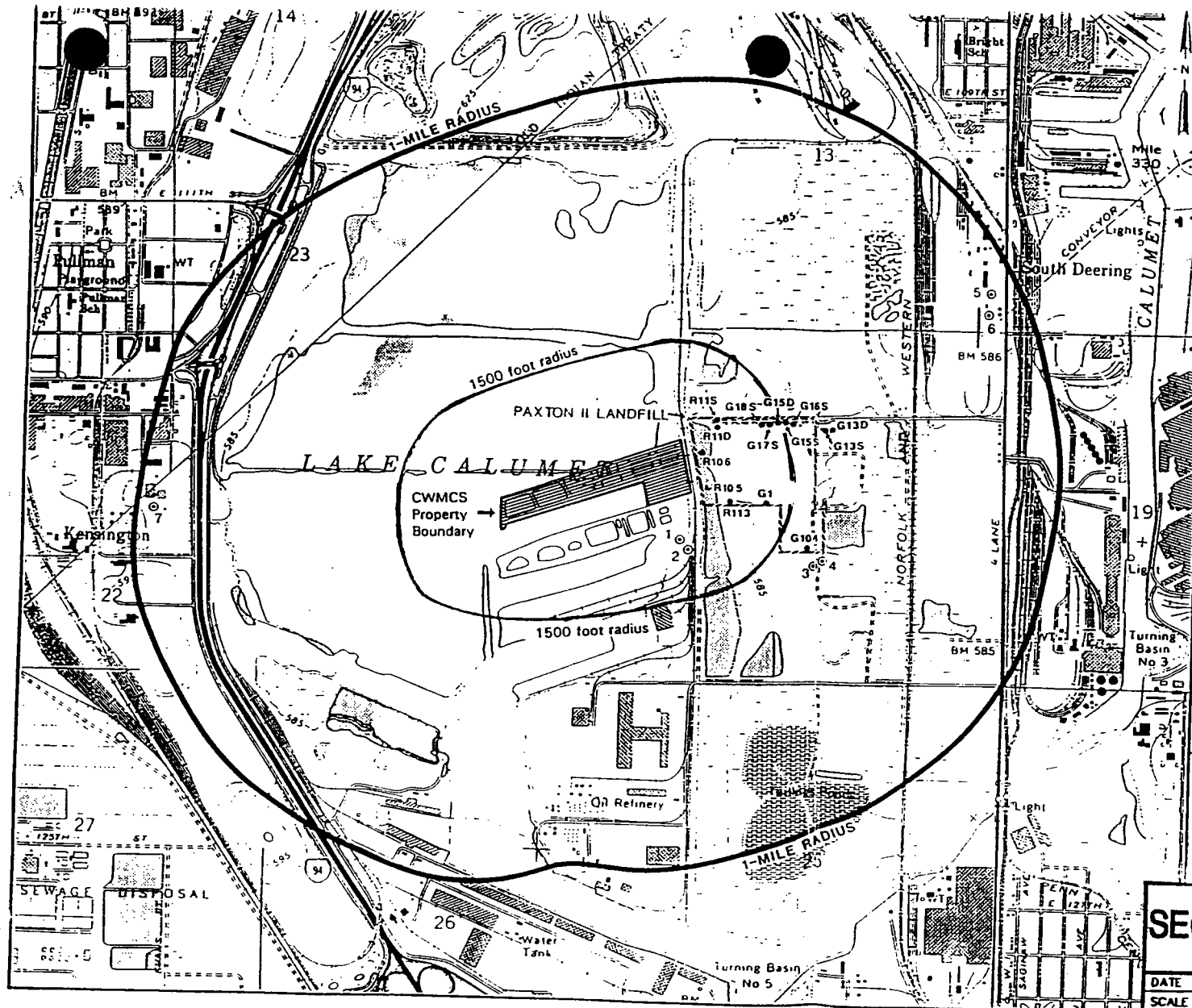
## 2.0 Background Information

The CWMCS facility is located at 11700 South Stony Island Avenue on a 31-acre site owned by the Illinois International Port in the southeastern section of the City of Chicago. The site consists of a pier and adjacent lands on the southeastern side of Lake Calumet. The pier structure was built in the late 1950's with fill consisting primarily of concrete rubble, masonry rubble, wood and metal scraps, sludge, slag, cinders and clay. The facility is located in the eastern half of Section 23 and the western half of Section 24, Township 37 North, Range 14 East, of the Third Principal Meridian, Cook County, Illinois.

The Facility location, including site and waste management area boundaries, as well as locations of the proposed groundwater monitoring system are shown on Figure B.2-2 located in Section B of the Part B Permit Application. Figure 2-1 shows the location of the facility and the groundwater wells within a 1500 foot radius of the facility.

### 2.1 Operation History

The CWMCS facility is operated by CWM Chemical Services, Inc. (formerly SCA), a subsidiary of Chemical Waste Management, Inc. SCA was purchased by Waste Management, Inc. in October, 1984. SCA purchased the assets of Hyon Waste Management, Inc. and Envirotherm/Illinois in September, 1980.



LEGEND:

- Groundwater Monitoring Well for Paxton II Landfill
- Groundwater Production Well

**NOTES:**

- Groundwater monitoring well locations for the Paxton II Landfill are based upon information obtained from the IEPA. Other monitoring wells likely exist at other landfill sites within the 1 mile radius (See Reference 13, Figure 3), however, access to these files at the IEPA was restricted.
- Production water well locations are based upon well logs obtained from the Illinois State Water Survey.

Modified from: Dames & Moore RFI

BASE MAP SOURCE:

USGS 7.5 Minute Topographic Quadrangle Map,  
Lake Calumet, ILL-IND, 1965, photorevised 197  
photoinspected 1977

SCALE: 1" = 1500

0 1500  
SCALE IN FEET

<b>SEC DONOHUE</b> Oak Brook, IL	<b>PROJECT</b> CWM Chemical Services Chicago Incinerator
	<b>TITLE</b> FACILITY LOCATION MAP AND GROUNDWATER WELL WITHIN A 1500 FOOT RAD
<b>DATE</b> 3/92	<b>FIGURE</b> FIGURE 2-1
<b>SCALE</b> 1" = 1500'	

The CWMCS facility presently treats, by thermal destruction, hazardous chemical wastes received from various sources. Wastes that are incinerated include organic liquids, solids, and sludges, as well as inorganic solids and liquids which have been contaminated with organics.

In addition to the incinerator, consisting of a rotary kiln and secondary combustion chamber, the CWMCS facility consists of an on-site bulk storage tank farm, container storage areas, a drum crusher and shredder, an air pollution control system, and a process water treatment system.

Prior to ownership by CWMCS, Hyon Waste Management, Inc. operations at the site included incineration of liquid and hazardous wastes, and the neutralization and biological treatment of hazardous wastes. Hyon Waste Management, Inc. operated the facility until 1979, when Hyon combined with Envirotherm/Illinois. Envirotherm operated the site for approximately 200 days, after which management of the site and all subsequent permits were purchased by SCA. SCA changed its name in September 1988, to CWM Chemical Services, Inc.

After purchase by SCA Chemical Services, the site underwent extensive redevelopment, which included excavation and removal of sludges and biobed wastes, with placement of these materials in a clay-lined vault west of the present surface impoundment area. Relining of the existing surface impoundments took place in 1982. These activities were

conducted in accordance with a 1981 Consent Agreement between the State of Illinois and the Illinois International Port.

The four surface impoundments, which had been in operation since 1980 were taken out of service on November 7, 1988. The total capacity of the surface impoundments was approximately 2 million gallons of process water and sludge. After the surface impoundments were taken out of service, the process water which was in the surface impoundments at that time was treated and discharged to the Metropolitan Water Reclamation District of Greater Chicago. The surface impoundments currently collect water only from precipitation events.

The two eastern surface impoundments were used to cool and store process water generated by the air pollution control system from the hazardous waste incinerator. The southwestern impoundment received stormwater runoff from the paved areas of the facility. The northwestern impoundment was used to receive and solidify sludges generated from the eastern basins.

Sludges from the two eastern surface impoundments would be periodically cleaned out and placed in the northwestern surface impoundment where the sludges would be solidified. Various equipment was utilized to solidify this sludge and subsequently remove this material. Spillage of the material during transfer to storage containers and clean-up of the equipment after leaving the surface impoundment, may have resulted in

the sludge material or process water being deposited outside of the surface impoundments.

The dimensions of the cooling basins are approximately 168 feet by 142 feet by 4 feet below ground surface. The solids retention basin is approximately 146 by 112 feet by 5.5 feet below ground surface. The stormwater retention basin is approximately 168 feet by 146 feet by 5.5 feet below ground surface. Previously, the solids retention and storm water surface impoundment basins were 4 feet below the ground surface but in an effort to clean close the units, 1.5 feet of clay was removed from the bottom of the surface impoundments.

Each impoundment was constructed with a 5-foot clay liner of  $10^{-7}$  cm/sec permeability. Dividing berms are also constructed of clay. A 3-foot perimeter berm was constructed around the surface impoundments to prevent stormwater run-on from entering the surface impoundments.

The process water and resultant sludges received in the cooling basins and the solids transferred to the retention basin were treatment residues resulting from the incineration of hazardous and non-hazardous wastes. These materials are hazardous by definition [35 IAC 721.103 (c)].

The surface impoundments were replaced by four 500,000 gallon, aboveground storage tanks. These tanks were placed into service on November 8, 1988.

## 2.2 Summary of Site Geology

The pier on which the surface impoundments of the CWMCS facility are located was constructed during the late 1950's by placing fill material over unconsolidated marsh and lacustrine deposits. The fill consists of cement fragments, masonry, rubble, wood and metal scraps, slag, sludge, cinders and clay. The fill material varies in thickness from about 7 to 18 feet.

The heterogeneous nature of the fill materials and the fact that fill materials have been placed below the water line of Lake Calumet make the hydrogeologic setting of the facility very unnatural. The fill is underlain by a thick continuous sequence of lacustrine silty clay and till which is acting as an aquiclude separating the fill unit from the bedrock aquifer. Monitoring wells, therefore, have been screened in the fill, which is the uppermost water-bearing formation, to provide a means for early detection of migration of hazardous waste or hazardous waste constituents that may have occurred from the surface impoundments.

In 1989, the CWMCS facility commenced a RCRA Facility Investigation (RFI) in which a variety of soil types were identified. A summary of the RFI is included in Section L of the RCRA Part B permit application.

The peat and organic silt are classified as belonging to the Holocene Grayslake Peat. The remainder of the soils in contact with the fill have been assigned to the Wisconsin age Equality Formation. The Equality Formation also underlies the Grayslake Peat at the site. The thickness of the Equality Formation is probably less than 20 feet in the site area.

Beneath the lacustrine soils of the Equality Formation are glacial deposits of the Wisconsin Wedron Formation. The glacial deposits of this formation, consisting primarily of clay and silt, may be as much as 70 feet thick in the site area. The glacial materials of the Wedron Formation are more consolidated than the overlying Equality Formation, and have been described as "over consolidated" in adjacent areas.

The Wisconsin glacial deposits, described above, unconformably overlie the Racine dolomite of the Niagaran Series, which is Silurian in age. Boreholes at the site have penetrated the Racine Dolomite. This unit lies approximately 75 feet to 85 feet below the surface and is finely to coarsely crystalline and very dense. This facility is not located near a fault.

### 2.3 Site Hydrogeology

A comprehensive discussion of the hydrogeology at the CWMCS Facility is found in the "Groundwater Assessment Report" by Golder (1987). This report is included as Appendix 6.



The fill material on which the CWMCS facility is located functions as the uppermost water bearing unit or zone beneath the site. The heterogeneous nature of the fill, and the fact that the fill materials have been placed below the Lake Calumet waterline, create an artificial hydrogeologic setting beneath the site. Beneath the fill material is a thick sequence of low permeability lacustrine deposits which inhibit the downward migration of groundwater into any underlying water-bearing zones.

During Phase I of the RFI, significant hydraulic conductivity contrasts were identified in the fill materials beneath the CWMCS facility. The RFI workplan states that studies completed in 1985 and 1986 by Golder Associates and P.E. LaMoreaux determined that the distribution of hydraulic conductivity values suggests that the fill to the north of the northeast and northwest basins of the surface impoundments and to the east of the northeast basin of the surface impoundments has a hydraulic conductivity one to two orders of magnitude greater than the fill materials to the south and west. North and east of the surface impoundments hydraulic conductivities range from  $5 \times 10^{-3}$  cm/sec to  $1 \times 10^{-4}$  cm/sec. The RFI workplan also states that south and west of the surface impoundments, hydraulic conductivities of the fill ranged from  $1 \times 10^{-4}$  cm/sec to  $8 \times 10^{-6}$  cm/sec. Hydraulic conductivity values for the fill were determined from bail tests. In previous studies conducted at the facility, the clayey materials beneath the fill were determined to have hydraulic conductivities of  $2.25 \times 10^{-8}$  cm/sec. Phase II of the RFI will verify hydraulic conductivities of the fill and clay.

A potentiometric surface map for the entire facility representing water levels obtained November 20, 1989 during Phase I of the RFI, is shown in Figure 2-2. Groundwater flows generally in a radial direction from a mounded area just east of the surface impoundments to the north, south, and west. Anomalous high water levels found in groundwater monitoring well (G110) west of the surface impoundments is attributed to the fact that this groundwater monitoring well is finished in the low conductivity materials (till) located below the man made fill.

Recharge to the uppermost water-bearing zone is from infiltration of precipitation. The fluctuations that occur are attributed to changes in the amount of precipitation, to changes in lake level affecting the perimeter groundwater monitoring wells, and to the nature of the fill materials (i.e., heterogeneous). Figure 2-3 shows the surface impoundments and fill materials in cross-section. Also depicted on this figure, are the seasonal high and low groundwater elevations based on information collected from the groundwater monitoring wells. The permeability of the fill and parent material is also shown.

Due to the spatial variability of hydraulic conductivities across for the site, groundwater velocities will vary depending upon location. A hydraulic gradient of 0.033 ft./ft. to the northwest and a velocity of 2 feet per day have been calculated for the northern portion of the site. For the southern portion of the site, a hydraulic gradient of 0.028 ft./ft. and a velocity of 0.16 feet per day was calculated between groundwater monitoring wells G112B and G124S.

FIGURE L.2-2A

# CWM CHEMICAL SERVICES, INC. CHICAGO INCINERATOR

## RCRA FACILITY INVESTIGATION

RFI PHASE I  
GROUNDWATER ELEVATIONS  
NOVEMBER 20, 1989

DRAWN BY: GFL-R 2/29/88

CHECKED BY: JPT 3/1/89

APPROVED BY: JSF 3.2.88

SCALE:

0 50 100

1 50

SCALE IN FEET

PROJECT NO:

13963 033 29

SHEET 2 OF 2

**Dames & Moore**



1845 HOFFMAN STREET MADISON WISCONSIN 53704

FIGURE L.2-2B

# CWM CHEMICAL SERVICES, INC. CHICAGO INCINERATOR

## RCRA FACILITY INVESTIGATION

RFI PHASE I  
GROUNDWATER ELEVATIONS  
NOVEMBER 20, 1989

DRAWN BY: GFL-R 2/29/88

CHECKED BY: OPT 3/1/88

APPROVED BY: JSF 5.1.88

SCALE:

0 50 100

1 50

SCALE IN FEET

PROJECT NO:

13963 033 29

SHEET 1 OF 2

**Dames & Moore** 

1845 HOFFMAN STREET MADISON WISCONSIN 53714 515 244 1168

FIGURE 2-3  
SURFACE IMPOUNDMENT CROSS-SECTION



Figures 2-4A,B

EXISTING MONITORING WELL LOCATIONS

Revision 2  
7/16/92

A review of the groundwater elevation data for the assessment monitoring wells (G120S, G121S, G123S, G124S and G307) collected over the time period from 10/90 through 4/91 indicated that groundwater monitoring well G307 was both an upgradient well and was not affected by past facility operations. Well G307 was added to the groundwater assessment monitoring program in October 1990 pursuant to an IEPA request. A review of the historic record of 15 quarters (4/87 through 4/91) shows that G123S is an upgradient monitoring well for the surface impoundments. The general groundwater flow direction trend for the assessment wells is towards the west/southwest. On occasion, the flow direction will vary slightly from the westerly direction.

A review of the groundwater elevation data for the state monitoring wells (G110, G111A, G112B, and G113A) collected over the time period from 4/88 through 4/91 shows that groundwater monitoring well G112B is an upgradient monitoring well for the surface impoundments. This data indicates that groundwater is flowing predominantly towards the southwest as seen in the assessment wells. The remainder of the time the groundwater flows towards the west/northwest.

The groundwater elevation data for 1990 indicates that the groundwater elevation rises consistently from winter through the summer and then drops to its lowest point during the fall. These data indicates tremendous variations in the groundwater surface elevations under the surface impoundments. Appendix 2A of this plan summarizes the groundwater elevation data for these groundwater monitoring wells.



#### 2.4 Existing Monitoring Programs

Groundwater monitoring has been performed at 14 groundwater monitoring wells at the CWMCS facility. All of the groundwater monitoring wells are located on-site. Four of these groundwater monitoring wells are monitored per State Permit No. 1981-46-OP-EXP (G110, G111A, G112B and G113A), five are monitored as part of the continuing groundwater assessment at the site (G120S, G121S, G123S, G124S, and G307), and five are monitored as part of the compliance agreement between the Illinois International Port and the IEPA (G101A, G102, G103, G104 and G105). Groundwater monitoring assessment well G126S which was installed in December 1991 as part of the Groundwater Monitoring Enhancements Work Plan, was added to the continuing groundwater assessment at the site during the first quarter of 1992.

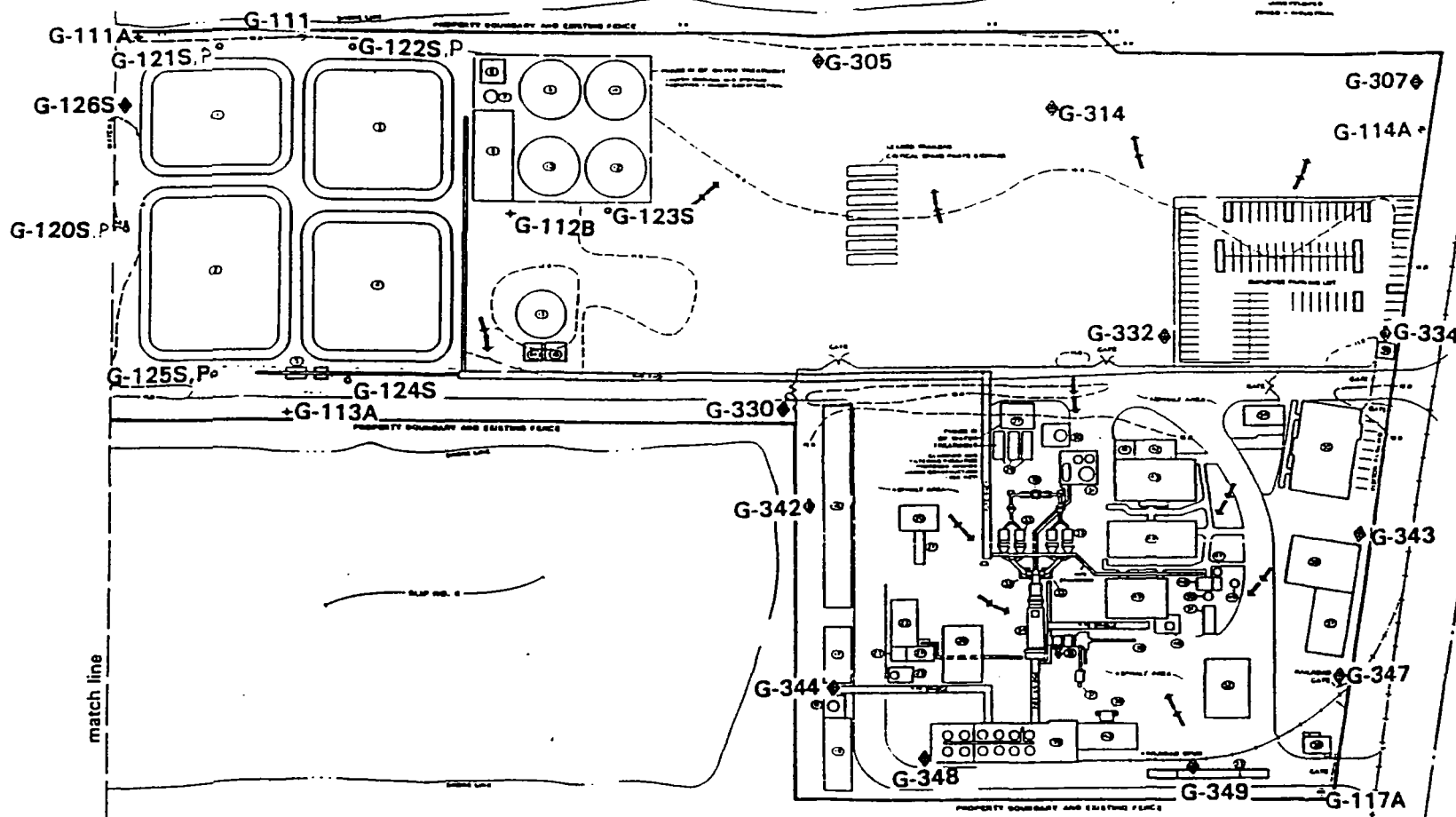
Of the four groundwater monitoring wells monitored per State Permit No. 1981-46-OP-EXP, one is upgradient of the surface impoundments (G112B), and three are downgradient (G110, G111A and G113A). Two of these groundwater monitoring wells are screened in the uppermost water-bearing zone beneath the site (G111A, G112B), one is screened in the silty clay below that zone (G110), and one is screened in both (G113A).

Of the six groundwater monitoring wells monitored as part of the continuing groundwater assessment at the site, two are upgradient of the surface impoundments (G123S and G307, the latter was installed pursuant to the approved RFI Work Plan and added to the

groundwater assessment monitoring program in 1990), and four are downgradient (G120S, G121S, G124S, G126S). All six groundwater monitoring wells are screened in the uppermost water-bearing zone beneath the facility.

Twenty-one groundwater monitoring wells have been installed as part of Phase I of the RFI. These groundwater monitoring wells are temporary and will only be used for the RFI investigation. These groundwater monitoring wells are G302, G303, G305, G307, G308, G314, G317, G318, G324 (utilized for water level information only), G330, G332, G334, G336, G337, G342, G343, G344, G347, G348 and G349.

All groundwater monitoring wells associated with the groundwater assessment program, the state permit, the IEPA-International Port consent agreement, and RFI are shown on Figures 2-4A and 2-4B. Additional groundwater monitoring wells identified on these figures are not currently included in the monitoring programs for the CWMCS facility.



**BUILDINGS AND FACILITY KEY:**

- |  |   |                           |                              |               |
|--|---|---------------------------|------------------------------|---------------|
| 1. Waste Transfer Station /<br>Residential Waste Water Plant<br>"Waste Transfer" - 100,000 sq ft | 16. Waste Water Storage Tank<br>"Waste Water Storage" - 100,000 sq ft | 31. Storage Tank          | 46. Waste Chemicals Building | 61. Fuel Tank |
| 2. Waste Water Plant<br>"Waste Water Plant" - 100,000 sq ft                                      | 17. Fuel Storage Building   | 32. Fuel Storage Building | 47. Fuel Tank                | 62. Fuel Tank |
| 3. Cooling & Heating Plant<br>"Cooling & Heating Plant" - 100,000 sq ft                          | 18. Fuel Storage Building   | 33. Fuel Storage Building | 48. Fuel Tank                | 63. Fuel Tank |
| 4. Cooling & Heating Plant<br>"Cooling & Heating Plant" - 100,000 sq ft                          | 19. Fuel Storage Building   | 34. Fuel Storage Building | 49. Fuel Tank                | 64. Fuel Tank |
| 5. Cooling Water Pump House<br>"Cooling Water Pump House" - 100,000 sq ft                        | 20. Fuel Storage Building   | 35. Fuel Storage Building | 50. Fuel Tank                | 65. Fuel Tank |
| 6. Cooling Water Pump House<br>"Cooling Water Pump House" - 100,000 sq ft                        | 21. Fuel Storage Building   | 36. Fuel Storage Building | 51. Fuel Tank                | 66. Fuel Tank |
| 7. Process Storage Tank<br>"Process Storage Tank" - 100,000 sq ft                                | 22. Fuel Storage Building   | 37. Fuel Storage Building | 52. Fuel Tank                | 67. Fuel Tank |
| 8. Fuel Storage Tank<br>"Fuel Storage Tank" - 100,000 sq ft                                      | 23. Fuel Storage Building   | 38. Fuel Storage Building | 53. Fuel Tank                | 68. Fuel Tank |
| 9. Fuel Storage Tank<br>"Fuel Storage Tank" - 100,000 sq ft                                      | 24. Fuel Storage Building   | 39. Fuel Storage Building | 54. Fuel Tank                | 69. Fuel Tank |
| 10. Fuel Storage Tank<br>"Fuel Storage Tank" - 100,000 sq ft                                     | 25. Fuel Storage Building   | 40. Fuel Storage Building | 55. Fuel Tank                | 70. Fuel Tank |
| 11. Fuel Storage Tank<br>"Fuel Storage Tank" - 100,000 sq ft                                     | 26. Fuel Storage Building   | 41. Fuel Storage Building | 56. Fuel Tank                | 71. Fuel Tank |
| 12. Fuel Storage Tank<br>"Fuel Storage Tank" - 100,000 sq ft                                     | 27. Fuel Storage Building   | 42. Fuel Storage Building | 57. Fuel Tank                | 72. Fuel Tank |
| 13. Fuel Storage Tank<br>"Fuel Storage Tank" - 100,000 sq ft                                     | 28. Fuel Storage Building   | 43. Fuel Storage Building | 58. Fuel Tank                | 73. Fuel Tank |
| 14. Fuel Storage Tank<br>"Fuel Storage Tank" - 100,000 sq ft                                     | 29. Fuel Storage Building   | 44. Fuel Storage Building | 59. Fuel Tank                | 74. Fuel Tank |
| 15. Fuel Storage Tank<br>"Fuel Storage Tank" - 100,000 sq ft                                     | 30. Fuel Storage Building   | 45. Fuel Storage Building | 60. Fuel Tank                | 75. Fuel Tank |

**LEGEND**

- ➔ DIRECTION OF SURFACE WATER DRAINAGE
- ASSESSMENT WELLS INSTALLED IN 1985  
WELL LOCATIONS CONSIST OF ONE  
STAINLESS STEEL AND ONE PVC WELL  
INSTALLED SIDE BY SIDE
- G-1235
- ◆ RCRA MONITORING WELLS INSTALLED IN 1981
- G-113A
- OTHER MONITORING WELLS INSTALLED IN 1981
- G-117A

**PHASE I INVESTIGATION LEGEND**

- ◆ S/SIL SAMPLING POINT CONVERTED INTO GROUNDWATER MONITORING WELL
- G-334

- NOTES:**
- Contour interval = 1 foot
  - Elevations shown on this drawing are based upon Chicago city datum
  - To convert to mean sea level datum add 578.80 feet to the elevations
  - All technical sheets are starting as of March 1988 unless otherwise noted
  - 100-year flood shown does not include levee system of Lake Calumet
  - Property of Factory

see following page for entire facility  
attach at match line

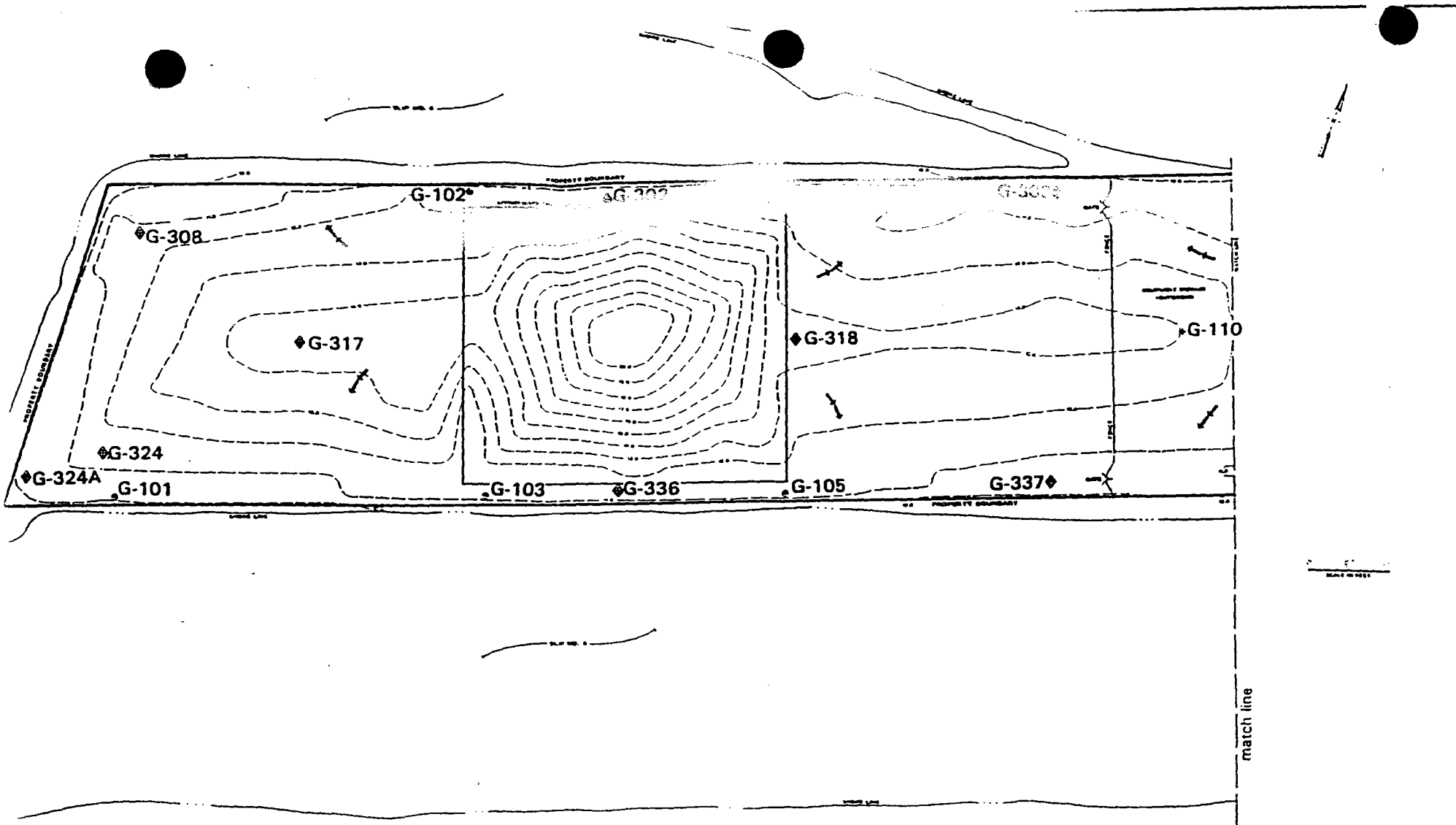
**PROJECT**  
CWM Chemical Services, Inc.  
Chicago Incinerator

**TITLE**  
EXISTING GROUNDWATER  
MONITORING WELL  
LOCATIONS

**FIGURE**  
FIGURE 2-4A

**SEC DONOT**  
Oak Brook, IL

**DATE** 3/92  
**SCALE** as shown



# LEGEND:



DIRECTION OF SURFACE WATER DRAINAGE

G-103



MONITORING WELLS INSTALLED IN 1981

G-110



RCRA MONITORING WELL INSTALLED IN 1981

## PHASE I INVESTIGATION - LEGEND:



G-336

SOIL SAMPLING POINT CONVERTED INTO GROUNDWATER MONITORING WELL

PROJECT	CWM Chemical Services, Inc. Chicago Incinerator
TITLE	EXISTING GROUNDWATER MONITORING WELL LOCATIONS
FIGURE	FIGURE 2-4B

**SEC DONOHUE**  
Oak Brook, IL

DATE 3/92  
SCALE as shown

ing are based upon Chicago city datum  
datum add 579.85 feet to the elevations shown  
ing as of March 1988 unless otherwise indicated  
extend beyond limits of Lake Calumet

Figures 3-1A,B

PROPOSED POST-CLOSURE GROUNDWATER  
COMPLIANCE MONITORING SYSTEM

### 3.0 Proposed Monitoring Well System

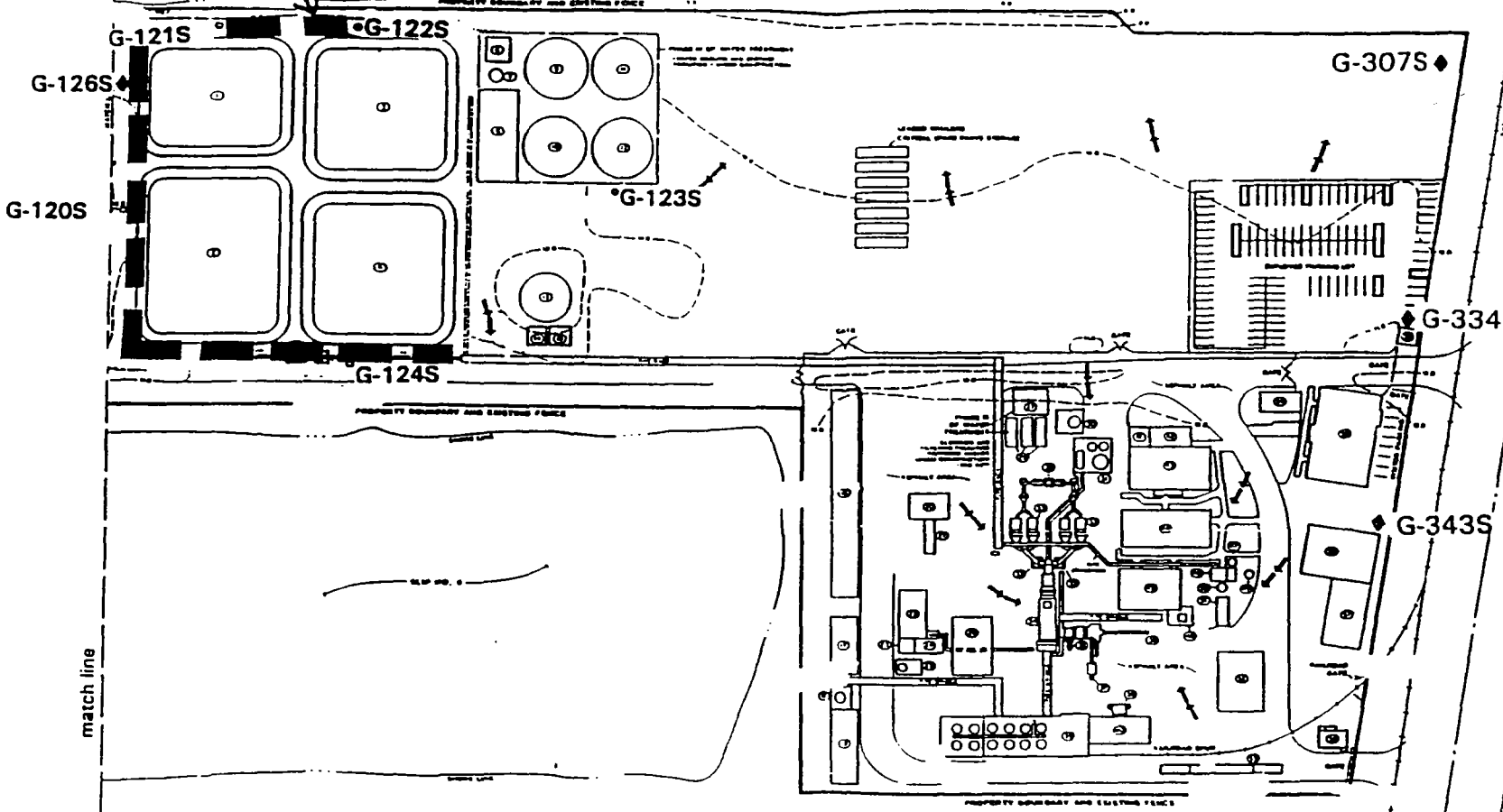
#### 3.1 Groundwater Monitoring Well Placement

The proposed post-closure groundwater compliance monitoring program for the surface impoundments will be performed using six existing and three proposed groundwater monitoring wells (Figures 3-1A and 3-1B) following the compliance monitoring requirements as outlined in 35 IAC 724.199. All groundwater monitoring wells are screened in the uppermost water-bearing zone.

Five of these groundwater monitoring wells, G120S, G121S, G122S, G123S, and G124S, were installed around the surface impoundments to supplement the information which could be obtained from the four state monitoring wells. These five groundwater monitoring wells were constructed with stainless steel screens and risers to a depth of approximately 19 feet below the ground surface. The three proposed groundwater monitoring wells will be constructed with 316 stainless steel or other inert material for the screen and risers.

Another groundwater monitoring well, G126S, is proposed as a downgradient groundwater monitoring well for the post-closure program and was originally installed in December 1991 pursuant to the Groundwater Monitoring Enhancements Work Plan required in the Second Amended Interim Consent Decree. Monitoring well G126S is constructed of 316 stainless steel to a depth of 15 feet below ground surface. This groundwater monitoring well has a 5 foot long screen and is set in the fill material. One

Point of Compliance



see following page for entire fa  
attach at match line

- NOTES:
- Contour interval = 1 foot
  - Benchmarks shown on this plan are based upon Chicago City datum
  - To support to north arrow and south arrow and 375.00 feet to the coordinate
  - All topographic points are shown up to March 1988 unless otherwise noted
  - 50-year flood plain data was obtained from State of Lake County in vicinity of facility

SCALE IN FEET

**BUILDING AND FACILITY KEY:**

- |   |   |   |   |   |
|---|---|---|---|---|
| 1. South Storage Room<br>• Building<br>• 100,000 sq. ft.  | 11. South Storage Room<br>• Building<br>• 100,000 sq. ft. | 21. Storage Room<br>• Building<br>• 100,000 sq. ft. | 31. South Storage Room<br>• Building<br>• 100,000 sq. ft. | 41. South Storage Room<br>• Building<br>• 100,000 sq. ft. |
| 2. South Storage Room<br>• Building<br>• 100,000 sq. ft.  | 12. South Storage Room<br>• Building<br>• 100,000 sq. ft. | 22. Storage Room<br>• Building<br>• 100,000 sq. ft. | 32. South Storage Room<br>• Building<br>• 100,000 sq. ft. | 42. South Storage Room<br>• Building<br>• 100,000 sq. ft. |
| 3. South Storage Room<br>• Building<br>• 100,000 sq. ft.  | 13. South Storage Room<br>• Building<br>• 100,000 sq. ft. | 23. Storage Room<br>• Building<br>• 100,000 sq. ft. | 33. South Storage Room<br>• Building<br>• 100,000 sq. ft. | 43. South Storage Room<br>• Building<br>• 100,000 sq. ft. |
| 4. South Storage Room<br>• Building<br>• 100,000 sq. ft.  | 14. South Storage Room<br>• Building<br>• 100,000 sq. ft. | 24. Storage Room<br>• Building<br>• 100,000 sq. ft. | 34. South Storage Room<br>• Building<br>• 100,000 sq. ft. | 44. South Storage Room<br>• Building<br>• 100,000 sq. ft. |
| 5. South Storage Room<br>• Building<br>• 100,000 sq. ft.  | 15. South Storage Room<br>• Building<br>• 100,000 sq. ft. | 25. Storage Room<br>• Building<br>• 100,000 sq. ft. | 35. South Storage Room<br>• Building<br>• 100,000 sq. ft. | 45. South Storage Room<br>• Building<br>• 100,000 sq. ft. |
| 6. South Storage Room<br>• Building<br>• 100,000 sq. ft.  | 16. South Storage Room<br>• Building<br>• 100,000 sq. ft. | 26. Storage Room<br>• Building<br>• 100,000 sq. ft. | 36. South Storage Room<br>• Building<br>• 100,000 sq. ft. | 46. South Storage Room<br>• Building<br>• 100,000 sq. ft. |
| 7. South Storage Room<br>• Building<br>• 100,000 sq. ft.  | 17. South Storage Room<br>• Building<br>• 100,000 sq. ft. | 27. Storage Room<br>• Building<br>• 100,000 sq. ft. | 37. South Storage Room<br>• Building<br>• 100,000 sq. ft. | 47. South Storage Room<br>• Building<br>• 100,000 sq. ft. |
| 8. South Storage Room<br>• Building<br>• 100,000 sq. ft.  | 18. South Storage Room<br>• Building<br>• 100,000 sq. ft. | 28. Storage Room<br>• Building<br>• 100,000 sq. ft. | 38. South Storage Room<br>• Building<br>• 100,000 sq. ft. | 48. South Storage Room<br>• Building<br>• 100,000 sq. ft. |
| 9. South Storage Room<br>• Building<br>• 100,000 sq. ft.  | 19. South Storage Room<br>• Building<br>• 100,000 sq. ft. | 29. Storage Room<br>• Building<br>• 100,000 sq. ft. | 39. South Storage Room<br>• Building<br>• 100,000 sq. ft. | 49. South Storage Room<br>• Building<br>• 100,000 sq. ft. |
| 10. South Storage Room<br>• Building<br>• 100,000 sq. ft. | 20. South Storage Room<br>• Building<br>• 100,000 sq. ft. | 30. Storage Room<br>• Building<br>• 100,000 sq. ft. | 40. South Storage Room<br>• Building<br>• 100,000 sq. ft. | 50. South Storage Room<br>• Building<br>• 100,000 sq. ft. |

**LEGEND:**

- ➔ DIRECTION OF SURFACE WATER DRAINAGE
- ASSESSMENT WELLS INSTALLED IN 1985  
WELL LOCATIONS CONSIST OF ONE  
STAINLESS STEEL AND ONE PVC WELL  
INSTALLED SIDE BY SIDE

**PHASE I INVESTIGATION LEGEND**

- ◆ SOIL SAMPLING POINT CONVERTED INTO GROUNDWATER MONITORING WELL

**PROJECT** CWM Chemical Services, Inc.  
Chicago Incinerator

**TITLE** PROPOSED POST-CLOSURE  
GROUNDWATER MONITORING  
SYSTEM

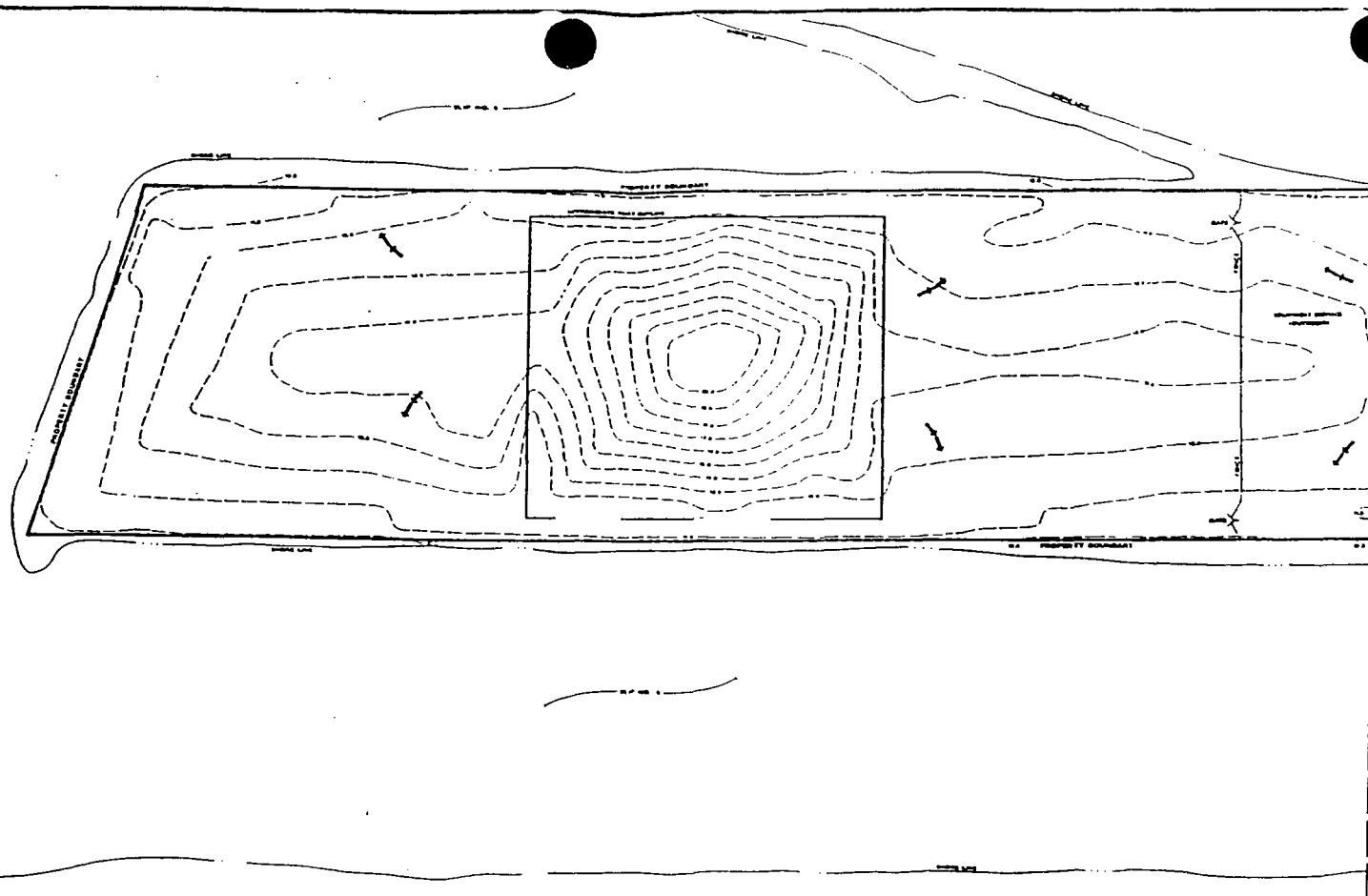
**FIGURE** FIGURE 3-1A

**SEC DONOH**  
Oak Brook, IL

**DATE** 3/92  
**SCALE** as shown

Modified from Dames & Moore RFI Report

LAKE CALUMET



**NOTES**

- Contour interval - 1 foot
- Elevations shown on this drawing are based upon Chicago city datum
- To convert to mean sea level datum add 579.88 feet to the elevations shown
- All facilities shown are existing as of March 1988 unless otherwise indicated
- 100-year flood plain does not extend beyond limits of Lake Calumet in vicinity of facility

**LEGEND:**



DIRECTION OF SURFACE WATER DRAINAGE

Modified from Dames & Moore RFI Report

<b>SEC DONOHUE</b> Oak Brook, IL	PROJECT	CWM Chemical Services, Chicago Incinerator
	TITLE	PROPOSED POST-CLOSURE GROUNDWATER MONITORING SYSTEM
DATE	3/92	
SCALE	as shown	
	FIGURE	FIGURE 3-1B cont



more groundwater monitoring well, G307, was installed upgradient of the surface impoundments as part of the ongoing RCRA Facility Investigation and was monitored for informational purposes as part of the continuing groundwater assessment program. Three stainless steel monitoring wells (G334S, G343S and G307S) will be installed adjacent to existing RFI monitoring wells G334, G343 and G307. These wells will be constructed using 316 stainless steel or other inert materials. These new groundwater monitoring wells will be upgradient to the surface impoundments and located along the eastern property line in an effort to further characterize upgradient, off-site sources.

The locations for G120S, G121S, G123S and G124S were originally selected because of their proximity to the State monitoring wells and because these locations would allow for immediate detection of any release of hazardous waste or hazardous waste constituents from the surface impoundments. These groundwater monitoring wells were constructed between the State groundwater monitoring wells and the edge of the surface impoundments. G122S was also selected because of its proximity to the surface impoundments. Upgradient groundwater monitoring well G123S is upgradient of the State groundwater monitoring well G112B.

For purposes of this proposed post-closure groundwater compliance monitoring program, the upgradient groundwater monitoring wells will include the existing groundwater monitoring well G123S and the proposed groundwater monitoring wells G334S, G343S

and G307S. The downgradient groundwater monitoring wells include G120S, G121S, G122S, G124S, and G126S.

Groundwater monitoring wells G120S, G121S, G122S, G124S, and G126S will be considered downgradient point of compliance wells for the surface impoundments. The point of compliance is the location where the groundwater quality standard is not to be exceeded. G123S will be considered the upgradient well for the surface impoundments. Wells G307S, G334S and G343S are designated as upgradient facility property line monitoring wells. The groundwater quality standard will be established for each groundwater monitoring well individually. Thus a different standard may apply to each groundwater monitoring well in determining whether there has been an exceedance (See Section 5.0).

As indicated in Section 5.0, the comparison of groundwater data between upgradient (G123S, G334S, G343S and G307S) and downgradient (G120S, G121S, G122S, G124S and G126S) groundwater monitoring wells at the point of compliance will not be made. Instead, an intra-well data evaluation will be conducted.

Any statistically significant increase in upgradient well measurements will trigger an evaluation of the groundwater at and in the vicinity of the well in question and potential off-site influences. If the increase is unrelated to the nature of the surface impoundments at the facility, then the compliance monitoring statistical program will be re-evaluated.

This re-evaluation will be conducted by updating background values for any naturally occurring parameters or the migration of parameters from off-site, on a periodic basis.

### 3.2 Groundwater Monitoring Well Construction

Groundwater monitoring well construction techniques are designed to maintain the integrity of the borehole, minimize introduction of extraneous materials, provide representative groundwater samples from the monitored zones, minimize maintenance and prevent entry of surface water into the annular space of the groundwater monitoring well. The materials used for groundwater monitoring well construction have been selected on the basis of (1) strength, (2) corrosion and resistance, (3) low interference with parameters to be monitored, (4) cost, and (5) compatibility with the drilling method employed.

The existing monitoring wells were drilled using hollow stem augers. Split spoon samples were obtained during the drilling activities. Groundwater monitoring wells G120S, G121S, G122S, G123S and G124S were completed to a depth of approximately 19 feet and are constructed of 2-inch stainless steel with 5-foot well screens. A sand and gravel mixture was installed around the screens as a filter pack. A bentonite seal was placed above the sand and gravel filter pack and the remaining annular space was filled with a cement-bentonite grout. Groundwater monitoring well G307 was completed to a depth of 14 feet and is constructed of 2-inch PVC with a 10-foot well screen. Sand was

installed around the screen and a bentonite seal was placed above the sand filter.

Portland cement was used at the ground surface to seal the well. Protective steel casings were placed over the riser of each groundwater monitoring well. Groundwater monitoring well G126S was completed to a depth of 15 feet and constructed of 2-inch diameter 316 stainless steel with a 5 foot well screen. A sand pack (#5 Torpedo) was installed around the screen. A bentonite seal was placed above the sand filter pack and the remaining annular space was filled with cement-bentonite grout.

The proposed groundwater monitoring wells (G334S, G343S and G307S) will be constructed in a similar manner to the construction of the other groundwater monitoring wells. These wells will be constructed using 316 stainless steel or other inert materials.

Groundwater monitoring wells G120S, G121S, G122S, G123S, G124S and G126S were developed by bailing. Groundwater monitoring well G307 was developed by nitrogen lift methods. Boring logs and construction summaries for the existing groundwater monitoring wells are included in Appendix 1.

#### 4.0 Sampling and Analytical Program

It is assumed that post-closure groundwater monitoring will be conducted by CWMCS personnel and/or personnel from Waste Management, Inc's Environmental Monitoring Laboratories, for most or all of the 30 year post-closure period. Thus, the sampling and analytical summaries below reflect this assumption.

##### 4.1 Sampling Plan

To the extent that CWM authorizes third-parties to sample and analyze groundwater, those third-parties will also follow CWM guidelines.

##### 4.1.1 Sampling Procedure Summary

The sampling program for post-closure care compliance monitoring for the surface impoundments will follow the CWM corporate guidelines as outlined in the most current revision of the copyrighted document, WMI Manual for Groundwater Sampling (Appendix 4). This manual details procedures for providing groundwater samples that are as representative as possible, so that the subsequent analysis will provide analytical data that are of the highest quality and fully defensible. This manual is updated periodically to reflect administrative changes (i.e., electronic data transfer procedures, or revisions to field forms) and EPA-approved protocols.

The plan for sampling groundwater at the CWMCS facility is described below. The sampling plan includes procedures and techniques for:

- (1) Collection;
- (2) Preservation and shipment; and
- (3) Chain of Custody Control

The following subsections describe general procedures and techniques for measurement of water levels, purging of groundwater monitoring wells, field measurements of pH, specific conductance and temperature, sample collection (bottles, preservation and shipping), and Chain-of-Custody control. Laboratory analytical procedures are contained in Section 4.4 of this plan.

#### 4.1.2 Procedures Prior to Sampling

General procedures followed prior to collection of a representative sample at each monitoring well are included in the WMI Manual for Groundwater Sampling (Sampling Manual). Presampling procedures are discussed in Section 4.2 of the Sampling Manual. Upon arrival at the groundwater monitoring well location, samplers will observe and record any problems with the condition of the groundwater monitoring well and its surrounding area on the sample Field Information Form (or equivalent) presented in Figure 4-1. Information to be noted on this form is included in the Sampling Manual in Section 4.2.2.2.

**FIGURE 4-1**

**Field Information Form**

# FIELD INFORMATION FORM

## PURGING INFORMATION

1 2 3 4 5 6 7 8 9 0  
PURGE DATE (YY MM DD)

1 2 3 4 5 6 7 8 9 0  
SHORT PURGE (YES/NO)

1 2 3 4 5 6 7 8 9 0  
ELAPSED TIME

1 2 3 4 5 6 7 8 9 0  
WATER VOL. IN CASING (GALLONS)

1 2 3 4 5 6 7 8 9 0  
ACTUAL VOLUME PURGED (GALLONS)

## PURGING AND SAMPLING EQUIPMENT

Purging Equipment .....Dedicated | Y | N |

Sampling Equipment .....Dedicated | Y | N |

Purging Device	<input type="checkbox"/> A-Submersible Pump	<input type="checkbox"/> D-Gas Lift Pump	<input type="checkbox"/> G-Bailer	X
Sampling Device	<input type="checkbox"/> B-Peristaltic Pump	<input type="checkbox"/> E-Venturi Pump	<input type="checkbox"/> H-Scoop/Shovel	X
	<input type="checkbox"/> C-Bladder Pump	<input type="checkbox"/> F-Dipper/Bottle	<input type="checkbox"/> I-Piston Pump	X
Purging Material	<input type="checkbox"/> A-Teflon	<input type="checkbox"/> C-Polypropylene	<input type="checkbox"/> E-Polyethylene	X
Sampling Material	<input type="checkbox"/> B-Stainless Steel	<input type="checkbox"/> D-PVC		X
Tubing-Purging	<input type="checkbox"/> A-Teflon	<input type="checkbox"/> D-Polypropylene	<input type="checkbox"/> F-Silicon	X
Tubing-Sampling	<input type="checkbox"/> B-Tygon	<input type="checkbox"/> E-Polyethylene	<input type="checkbox"/> G-Combination Teflon/Polypropylene	X
	<input type="checkbox"/> C-Rope X			X
Filtering Devices 0.45 $\mu$ :	<input type="checkbox"/> A-In-line Disposable	<input type="checkbox"/> B-Pressure	<input type="checkbox"/> C-Vacuum	

## FIELD MEASUREMENTS

Well Elevation	<span style="border: 1px solid black; padding: 2px;">1 2 3 4 5 6 7 8 9 0</span> (ft/m)	Land Surface Elevation	<span style="border: 1px solid black; padding: 2px;">1 2 3 4 5 6 7 8 9 0</span> (ft/m)
Depth to water	<span style="border: 1px solid black; padding: 2px;">1 2 3 4 5 6 7 8 9 0</span> (ft)	Depth to water	<span style="border: 1px solid black; padding: 2px;">1 2 3 4 5 6 7 8 9 0</span> (ft)
From top of well casing		From land surface	
Groundwater Elevation	<span style="border: 1px solid black; padding: 2px;">1 2 3 4 5 6 7 8 9 0</span> (ft/m)	Groundwater Elevation	<span style="border: 1px solid black; padding: 2px;">1 2 3 4 5 6 7 8 9 0</span> (ft/m)
Well Depth	<span style="border: 1px solid black; padding: 2px;">1 2 3 4 5 6 7 8 9 0</span> (ft)	Stickup	<span style="border: 1px solid black; padding: 2px;">1 2 3 4 5 6 7 8 9 0</span> (ft)
1st <span style="border: 1px solid black; padding: 2px;">1 2 3 4 5 6 7 8 9 0</span> (STD)	1st <span style="border: 1px solid black; padding: 2px;">1 2 3 4 5 6 7 8 9 0</span> $\mu$ m/cm at 25° C	Sample Temp.	<span style="border: 1px solid black; padding: 2px;">1 2 3 4 5 6 7 8 9 0</span> (°C)
2nd <span style="border: 1px solid black; padding: 2px;">1 2 3 4 5 6 7 8 9 0</span> (STD)	2nd <span style="border: 1px solid black; padding: 2px;">1 2 3 4 5 6 7 8 9 0</span> $\mu$ m/cm at 25° C		<span style="border: 1px solid black; padding: 2px;">1 2 3 4 5 6 7 8 9 0</span>
3rd <span style="border: 1px solid black; padding: 2px;">1 2 3 4 5 6 7 8 9 0</span> (STD)	3rd <span style="border: 1px solid black; padding: 2px;">1 2 3 4 5 6 7 8 9 0</span> $\mu$ m/cm at 25° C		<span style="border: 1px solid black; padding: 2px;">1 2 3 4 5 6 7 8 9 0</span>
4th <span style="border: 1px solid black; padding: 2px;">1 2 3 4 5 6 7 8 9 0</span> (STD)	4th <span style="border: 1px solid black; padding: 2px;">1 2 3 4 5 6 7 8 9 0</span> $\mu$ m/cm at 25° C		<span style="border: 1px solid black; padding: 2px;">1 2 3 4 5 6 7 8 9 0</span>

## FIELD COMMENTS

Sample Appearance: \_\_\_\_\_ Odor: \_\_\_\_\_ Color: \_\_\_\_\_ Turbidity: \_\_\_\_\_

Weather Conditions: Wind Speed \_\_\_\_\_ Direction \_\_\_\_\_ Precipitation Y/N \_\_\_\_\_

Specific Comments: \_\_\_\_\_

I certify that sampling procedures were in accordance with applicable EPA, State and WMI protocols.

Signature: \_\_\_\_\_ Employer: \_\_\_\_\_



Prior to groundwater purging and sample withdrawal, an accurate water-level measurement is taken with a portable, conventional electric slope indicator or fiberglass tape (i.e., if electric slope indicator is not functional). The water level measurement is recorded on the Field Information Form.

#### 4.1.3 Sample Collection

The sampling system at the CWMCS facility dedicates all purging and sampling equipment to the groundwater monitoring well, thus preventing any potential cross contamination between groundwater monitoring wells that may be otherwise incurred during conventional water sampling practices. Samples are extracted using dedicated stainless steel bailers.

The procedures and protocol that are followed during groundwater sampling are included in Section 4.3 of the Sampling Manual.

The equivalent of three standing water volumes (based on casing diameter), measured from the depth to water to base of the groundwater monitoring well are evacuated from the groundwater monitoring well prior to sampling to assure that samples are drawn from the aquifer, not from stagnant water left in the groundwater monitoring well between sampling events. Should three groundwater monitoring well volumes not be available, the groundwater monitoring well will be purged dry. If a groundwater monitoring well does not recharge within a reasonable time period (24 hours) as part of the quarterly

sampling event, then professional judgement will be utilized to determine when a sufficient volume is available for obtaining a sample from the groundwater monitoring well. When the first opportunity to collect a sample has occurred, a sample will be collected and handled as if it were part of the quarterly sampling event. This situation will be documented, the length of time needed to obtain the sample and the reason for the sampling delay will be noted, in order to qualify the analytical results. This documentation will be provided to the Agency as part of the reporting requirements.

If recharge is insufficient to fill all sample bottles, minimum sample volumes will be provided (as specified by the laboratory) with samples for organic constituents first. The Environmental Manager (or designee) will be notified when a normally yielding groundwater monitoring well is non-yielding at a sampling event. The groundwater removed from each well prior to sampling will be managed as hazardous waste unless CWMCS demonstrates that the purge water does not exhibit the characteristics of hazardous waste or hazardous waste constituents are not present in the groundwater.

Quadruplicate measurements of specific conductance and pH will be recorded subsequent to groundwater monitoring well evacuation. Groundwater temperature will be recorded prior to sampling. Procedures provided with the instruments will be used for calibration and testing. All results will be recorded on the Field Information Form, noting units to three significant figures.

#### 4.1.4 Sample Preservation and Shipment

- Detailed instructions for the preservation, storage, and shipment of groundwater samples, including chain-of-custody control are included in Section 4.4 of the Sampling Manual.

Immediately after collection, sample bottles will be placed in insulated AquaPaks or coolers with ice packs and sealed. These will be sent to the WMI Environmental Monitoring Laboratories, Inc. (EML), Geneva, Illinois or an equivalent laboratory and will arrive within appropriate holding times. Signed Field Chain-of-Custody Records and Field Information Forms will be placed inside the sample shipping containers.

#### 4.1.5 Chain of Custody

At the time each sample is taken, a Field Chain-of-Custody Record (Figure 4-2), or equivalent, will be completed and placed in the sample shipping container. Upon transfer of sample possession to subsequent custodians, the Field Chain-of-Custody Record(s) will be signed by the person taking custody of the sample shipping container and its contents. Upon receipt of the samples at the laboratory, the shipping container seal will be broken and the condition of samples will be recorded by the receiver. The Field Chain-of-Custody Record and the Field Information Form will be included in the analytical report prepared by the laboratory, and will be considered an integral part of that report.

As part of the Chain-of-Custody procedure, each sample container will be labeled with the sample number and the parameter to be sampled.

All sampling procedures, measurements, and observations will be recorded on the Field

Forms. The following information will be documented on the Field Forms:

- o Facility site name, sample point identification number, and other pertinent identifiers.
- o Depth to groundwater.
- o Information regarding purging the groundwater monitoring well prior to sampling.
- o Date and elapsed time from sample start to sample finish (if elapsed hours are greater than one).
- o Sampling method--dedicated stainless steel bailer.
- o Samples filtered.
- o Field test results, including pH, temperature, and specific conductance.
- o Type of sample and necessary treatment (e.g., filtering, if necessary).
- o Field observations (e.g., well condition).
- o Appearance of sample (i.e., color, turbidity, odor).
- o Sampler's identity and signature.

**FIGURE 4-2**

**Field Chain-of-Custody Record**

AquaPak # \_\_\_\_\_  
 Date Sealed 

--	--	--	--	--	--

  
 Seal # \_\_\_\_\_  
 By: \_\_\_\_\_

SITE/FACILITY # [ ] [ ] [ ] SITE NAME: \_\_\_\_\_

**Sample Point:**

SAMPLE DATE: -                                              

SAMPLE TIME:     :    :    

**MATRIX CODE:** \_\_\_\_\_

Water .....	(14)	Leachman .....	(25)
Soil .....	(3)	Other .....	(8)

### Source Codes

Water	(F)	Leachate System	(C)	Pre-treatment Facility	(P)	River-Brown-Brown	(R)	San	(S)	Sanitation P	(S)
Decontamination Pressure Relief	(D)	Gas Concentrators	(G)	Influent	(U)	Land or Ocean	(L)	Bottom Sediment	(B)	Other	(O)
Surface Water Impoundment	(I)	Air	(A)	Sludge	(T)	Cultural	(C)	Water	(W)	Landfill	(L)

ENS #

## AquaPak® CONTENT

[illegible]

## CHAIN OF CUSTODY CHRONICLE

1. AquaPak<sup>®</sup> Opened By: (print) \_\_\_\_\_ Date: \_\_\_\_/\_\_\_\_/\_\_\_\_ Time: \_\_\_\_:\_\_\_\_:\_\_\_\_  
Signature: \_\_\_\_\_ Seal #: \_\_\_\_\_ Intact: \_\_\_\_\_ 2400 HR.

**I have received these materials in good condition from the above person.**

2. Name: \_\_\_\_\_ Signature: \_\_\_\_\_  
Date: \_\_\_\_/\_\_\_\_/\_\_\_\_ Time: \_\_\_\_:\_\_\_\_:\_\_\_\_  
2400 HR. Remarks: \_\_\_\_\_

**I have received these materials in good condition from the above person.**

3. Name: \_\_\_\_\_ Signature: \_\_\_\_\_  
Date: \_\_\_\_/\_\_\_\_/\_\_\_\_ Time: \_\_\_\_:\_\_\_\_:\_\_\_\_  
2400 HR. Remarks: \_\_\_\_\_

AquaPak® Sealed By: (print) \_\_\_\_\_ Date: \_\_\_\_/\_\_\_\_/\_\_\_\_ Time: \_\_\_\_:\_\_\_\_:\_\_\_\_  
Signature: \_\_\_\_\_ Seal #: \_\_\_\_\_ Intact: \_\_\_\_\_ 2400 HR.

**LAB USE ONLY**

Opened By: (Signature) Date:   /  /   Time:   :  

AquaPak® # \_\_\_\_\_ TEMP. °C \_\_\_\_\_ SEAL # \_\_\_\_\_ INTACT. \_\_\_\_\_  
ORIGINAL LAB

Upon receipt of the samples at the laboratory, the date and time of arrival will be noted on the Field Chain-of-Custody Records. The laboratory receiver will verify that the seal is intact and custody has not been broken, and make note of sample bottle condition on the forms. These forms will be retained by the laboratory and will be returned with the results of the analyses.

#### 4.1.6 Sample Contact

Sampling at the CWMCS facility is conducted under the direction of the facility's Environmental Manager (or designee) utilizing site personnel or outside contracted sampling technicians. Technicians are trained per the WMI Manual for Groundwater Sampling. The contact person during operation of the facility is the Environmental Manager. If post-closure groundwater monitoring is required following final closure of the Incinerator facility, sampling and analysis will be conducted under the direction of: Vice-President of Environmental Management, Chemical Waste Management, Inc., 3001 Butterfield Road, Oak Brook, IL 60521, (708) 218-1500.

#### 4.2 Existing Monitoring Data and Results of Evaluations

Based upon a review of all quarterly groundwater and surface impoundment analytical data (including the most recent results for the 4th quarter, 1991), and the groundwater monitoring data from the two previous groundwater assessments, there is no data to suggest that a release of hazardous waste constituents from the surface impoundments has

occurred which has exceeded the standards promulgated in 35 IAC Part 620 and 35 IAC - 724.194.

The data continue to indicate the following:

1. The surface impoundments are not the source of organic constituents that have been found in samples taken from the groundwater monitoring wells.
2. The concentration of organics and inorganics in samples from the groundwater monitoring wells is relatively consistent over the last four years, with the exception of groundwater monitoring well G123S as indicated below.
3. The increase in organic constituents noted in groundwater monitoring well G123S is likely attributable to upgradient sources. This is supported by the results of Phase I of the RFI and should be confirmed by Phase II of the RFI.
4. The results do not indicate a release from the surface impoundments of hazardous waste or hazardous waste constituents to groundwater.
5. Recent groundwater elevations are consistent with previous data.

Appendix 2 contains the Groundwater Assessment Program Fourth Quarter 1991 Report for the groundwater monitoring program. A summary of historical data by sampling location is included in Appendix 3. All data and reports (i.e., RFI, Groundwater assessments, etc.) have been made available to the Agency as part of the interim status operations. The 1987 Groundwater Assessment Report by Golder is included as Appendix 6.



### 4.3 Sample Parameters and Frequency

#### 4.3.1 Sampling Frequency

All groundwater samples will be analyzed for the parameters, and according to the frequency, listed in Table 4-1. Samples from each monitoring well in the post-closure system will be collected at least quarterly during the compliance period for the facility. Samples will be collected on a quarterly basis and the Appendix I analyses will be conducted annually. Appendix I samples will be collected in the first quarter of the first year of compliance monitoring. Subsequent annual Appendix I sampling and analyses will be conducted the same quarter of each year.

#### 4.3.2 Selection of Parameters

Previous monitoring results from the groundwater assessment monitoring program were utilized to evaluate parameters appropriate for a post-closure monitoring program. The results from the groundwater monitoring wells were compared to surface impoundment water and sludge data to determine a chemical fingerprint. These results provide a basis for selecting naturally occurring inorganic constituents as parameters for quarterly analyses. The organic constituents are based upon the groundwater assessment parameters. The menu of constituents provides for use of two distinct statistical techniques to clearly monitor any impacts from the surface impoundments. As requested by the IEPA, in a letter dated June 14, 1992, the following parameters will be added to the routine quarterly groundwater monitoring list upon approval of the Interim Status Closure Plan: Chromium, Cadmium, Acetonitrile, Ethyl Cyanide, Methyl Ethyl Ketone, 1,1,2-Trichloroethane, and Methyl Isobutyl Ketone.

TABLE 4-1

Water Quality Parameters for Groundwater Monitoring

Quarterly

Field Parameters

Specific Conductance

Groundwater Surface Elevation

pH

Temperature

Water Surface Elevation of Lake Calumet

Acids/Bases/Neutrals

1,2-Dichlorobenzene

2,4-Dichlorophenol

2,4-Dimethylphenol

2,6-Dichlorophenol

2-Chlorophenol

Aniline

Anthracene

4-Chloroaniline

Cresol, m+p

Naphthalene

Phenol

Inorganics

Chloride

Fluoride

Metals (total and dissolved)

Aluminum

Arsenic

Barium

Cadmium

Chromium

Iron

Lead

Sodium

Zinc

TABLE 4-1 (Continued)

Water Quality Parameters for Groundwater Monitoring

Volatile Organics

Acetone  
Acetonitrile  
Benzene  
Chlorobenzene  
1,1-Dichloroethylene  
Dichlorodifluoromethane  
Ethylbenzene  
Ethyl Cyanide  
Methylene Chloride  
Methyl Ethyl Ketone  
Methyl Isobutyl Ketone  
p-Dioxane  
1,1,2-Trichloroethane  
Toluene  
Vinyl Chloride  
Xylene (meta, para, ortho)

Annually

Appendix I (as listed in 35 IAC 724) and Quarterly Parameters which are not included in Appendix I.

Confirmatory for new constituents within 30 days of receipt of analytical results, as needed

A list of the Appendix I parameters follows.

Common Name	CAS RN	Chemical Abstracts Service Index Name	Suggested Methods	POL (ng/L)
Acenaphthene	83-32-9	Acenaphthylene, 1,2-dihydro-	8100	200.
Acenaphthylene	208-96-8	Acenaphthylene	8270	10.
Acetone	67-64-1	2-Propanone	8100	20.
Acetophenone	98-86-2	Ethanone, 1-phenyl-	8270	10.
Acetonitrile; Methyl cyanide	75-05-8	Acetonitrile	8015	100.
2-Acetylaminofluorene; 2-AAF	53-96-3	Acetamide, N-9H-fluoren-2-yl-	8270	10.
Acrolein	107-42-8	2-Propenal	8030	10.
Acrylonitrile	107-13-1	2-Propenenitrile	8240	10.
Aldrin	309-00-2	1,4,5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexachloro- 1,4,4a,5,8,8a-hexahydro-(1alpha, 4alpha, 4beta, 5alpha, 8alpha, 8beta)-	8080	0.05
Allyl chloride	107-05-1	1-Propene, 3-chloro-	8010	10.
4-Aminobiphenyl	92-67-1	[1,1'-Biphenyl]-4-amine	8270	10.
Aniline	62-53-3	Benzenamine	8270	10.
Anthracene	120-12-7	Anthracene	8100	10.
Antimony	(Total)	Antimony	8270	10.
Aramite	140-57-8	Sulfurous acid, 2-chloroethyl 2-[4-(1,1-dimethylethyl)phenoxy] -1-methylethyl ester	6010	200.
Arsenic	(Total)	Arsenic	7041	10.
Barium	(Total)	Barium	7060	10.
Benzene	71-43-2	Benzene	7061	20.
Benzo(a)anthracene; Benzanthracene	56-55-3	Benzo(a)anthracene	6010	20.
Benzo(b)fluoranthene	205-99-2	Benzo(e)acephenanthrylene	7080	1000.
Benzo(k)fluoranthene	207-08-9	Benzo(k)fluoranthene	8020	20.
Benzo(ghi)perylene	191-24-2	Benzo(ghi)perylene	8240	10.
Benzo(a)pyrene	50-32-8	Benzo(a)pyrene	8100	200.
Benzyl alcohol	100-51-6	Benzenemethanol	8270	10.
Beryllium	(Total)	Beryllium	8270	20.
alpha-BHC	319-84-6	Cyclohexane, 1,2,3,4,5,6- hexachloro-(1alpha, 2alpha, 3beta, 4alpha, 5beta, 6beta)-	6010	3.
beta-BHC	319-85-7	Cyclohexane, 1,2,3,4,5,6- hexachloro-(1alpha, 2beta, 3alpha, 4beta, 5alpha, 6beta)-	7090	30.
delta-BHC	319-86-8	Cyclohexane, 1,2,3,4,5,6- hexachloro-(1alpha, 2alpha, 3alpha, 4beta, 5alpha, 6beta)-	7091	2.
gamma-BHC; Lindane	58-89-9	Cyclohexane, 1,2,3,4,5,6- hexachloro-(1alpha, 2alpha, 3beta, 4alpha, 5alpha, 6beta)-	8080	0.05
Bis(2-chloroethoxy)methane	111-91-1	Ethane, 1,1'-(methylenebis (oxy))bis(2-chloro-	8250	10.
Bis(2-chloromethyl)ether	111-44-4	Ethane, 1,1'-oxybis(2-chloro-	8080	0.1
Bis(2-chloro-1-methylethyl) ether; 2,2'-	108-60-1	Propane, 2,2'-oxybis(1-chloro-	8250	10.
Dichlorodipropyl ether	117-81-7	1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester	8270	10.
Bis(2-ethylhexyl) phthalate	75-27-4	Methane, bromodichloro-	8060	20.
Bromodichloromethane			8270	10.
			8010	1.
			8240	5.

Common Name	CAS RN	Chemical Abstracts Service Index Name	Suggested Methods	POL (ug/L)
Bromoforn: Tribromomethane	75-25-2	Methane, tribromo-	8010	2.
			8240	5.
4-Bromophenyl phenyl ether	101-55-3	Benzene, 1-bromo-4-phenoxy-	8270	10.
Butyl benzyl phthalate:	85-68-7	1,2-Benzenedicarboxylic acid, butyl phenylmethyl ester	8060	5.
Benzyl butyl phthalate			8270	10.
Cadmium	Total	Cadmium	6010	40.
			7130	50.
			7131	1.
Carbon disulfide	75-15-0	Carbon disulfide	8240	5.
Carbon tetrachloride	56-23-5	Methane, tetrachloro-	8010	1.
			8240	5.
Chlordane	57-74-9	4,7-Methano-1H-indene, 1,2,4,5,6,7,8,8-octachloro-2,3,3a,4,7,7a-hexahydro-	8080	0.1
			8250	10.
p-Chloroaniline	106-47-8	Benzenamine, 4-chloro-	8270	20.
Chlorobenzene	108-90-7	Benzene, chloro-	8010	2.
			8020	2.
			8240	5.
Chlorobenzilate	510-15-6	Benzoic acid, 4-chloro-alpha-(4-chlorophenyl)-alpha-hydroxy-ethyl ester	8270	10.
p-Chloro-m-cresol	59-50-7	Phenol, 4-chloro-3-methyl-	8040	5.
Chloroethane: Ethyl chloride	75-00-3	Ethane, chloro-	8270	20.
			8010	5.
Chloroform	67-66-3	Methane, trichloro-	8240	10.
			8010	0.5
2-Chloronaphthalene	91-58-7	Naphthalene, 2-chloro-	8240	5.
			8120	10.
2-Chlorophenol	95-57-8	Phenol, 2-chloro-	8270	10.
			8040	5.
4-Chlorophenyl phenyl ether	7005-72-3	Benzene, 1-chloro-4-phenoxy-	8270	10.
Chloroprene	126-99-8	1,3-Butadiene, 2-chloro-	8010	90.
			8240	5.
Chromium	(Total)	Chromium	6010	70.
			7190	500.
			7191	10.
Chrysene	218-01-9	Chrysene	8100	200.
			8270	10.
Cobalt	(Total)	Cobalt	6010	70.
			7200	500.
			7201	10.
Copper	(Total)	Copper	6010	60.
			7210	200.
m-Cresol	108-39-4	Phenol, 3-methyl-	8270	10.
o-Cresol	95-48-7	Phenol, 2-methyl-	8270	10.
p-Cresol	106-44-5	Phenol, 4-methyl-	8270	10.
Cyanide	57-12-5	Cyanide	9010	40.
2,4-D: 2,4-Dichlorophenoxyacetic acid	94-75-7	Acetic acid, (2,4-dichlorophenoxy)-	8150	10.
4,4'-DDD	72-54-8	Benzene, 1,1'-(2,2-dichloroethylidene) bis(4-chloro-	8080	0.1
4,4'-DDE	72-55-9	Benzene, 1,1'-(2,2-dichloroethylidene) bis(4-chloro-	8270	10.
			8080	0.05
4,4'-DDT	50-29-3	Benzene, 1,1'-(2,2,2-trichloroethylidene) bis(4-chloro-	8270	10.
			8080	0.1
Diallate	2303-16-4	Carbamethioic acid, bis(1-methylethyl)-, S-(2,3-dichloro-2-propenyl) ester	8270	10.
Dibenz[a,h]anthracene	53-70-3	Dibenz[a,h]anthracene	8100	200.
			8270	10.
Dibenzofuran	132-64-9	Dibenzofuran	8270	10.
Dibromochloromethane:	124-48-1	Methane, dibromochloro-	8010	1.
Chlorodibromomethane			8240	5.
1,2-Dibromo-3-chloropropane: DBCP	96-12-8	Propane, 1,2-dibromo-3-chloro-	8010	100.
			8240	5.
			8270	10.
1,2-Dibromoethane: Ethylene dibromide	106-93-4	Ethane, 1,2-dibromo-	8010	10.
			8240	5.

Common Name	CAS RN	Chemical Abstracts Service Index Name	Suggested Methods	POL (ug/L)
Di-n-butyl phthalate	84-74-2	1,2-Benzenedicarboxylic acid, dibutyl ester	8080 8270	5. 10.
o-Dichlorobenzene	95-50-1	Benzene, 1,2-dichloro-	8010 8020 8120 8270	2. 5. 10. 10.
m-Dichlorobenzene	541-73-1	Benzene, 1,3-dichloro-	8010 8020 8120 8270	5. 5. 10. 10.
p-Dichlorobenzene	106-46-7	Benzene, 1,4-dichloro-	8010 8020 8120 8270	2. 5. 15. 10.
3,3'-Dichlorobenzidine	91-94-1	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dichloro-	8270	20.
trans-1,4-Dichloro-2-butene	110-57-6	2-Butene, 1,4-dichloro-, (E)-	8240	5.
Dichlorodifluoromethane	75-71-8	Methane, dichlorodifluoro-	8010 8240	10. 5.
1,1-Dichloroethane	75-34-3	Ethane, 1,1-dichloro-	8010 8240	1. 5.
1,2-Dichloroethane; Ethylene dichloride	107-06-2	Ethane, 1,2-dichloro-	8010 8240	0.5 5.
1,1-Dichloroethylene; Vinylidene chloride	75-35-4	Ethene, 1,1-dichloro-	8010 8240	1. 5.
trans-1,2-Dichloroethylene	156-60-5	Ethene, 1,2-dichloro-, (E)-	8010 8240	1. 5.
2,4-Dichlorophenol	120-83-2	Phenol, 2,4-dichloro-	8040 8270	5. 10.
2,6-Dichlorophenol	87-65-0	Phenol, 2,6-dichloro-	8270	10.
1,2-Dichloropropane	78-87-5	Propane, 1,2-dichloro-	8010 8240	0.5 5.
cis-1,3-Dichloropropene	10061-01-5	1-Propene, 1,3-dichloro-, (Z)-	8010 8240	20. 5.
trans-1,3-Dichloropropene	10061-02-6	1-Propene, 1,3-dichloro-, (E)-	8010 8240	5. 5.
Dieldrin	60-57-1	2,7:3,6-Dimethanonaphth[2,3- b]oxirene, 3,4,5,6,9,9-hexachloro- 1a,2,2a,3,6,6a,7,7a-octahydro-, (1aalpha, 2beta, 2aalpha, 3beta, 6beta, 6aalpha, 7beta, 7aalpha)-	8080 8270	0.05 10.
Diethyl phthalate	84-66-2	1,2-Benzenedicarboxylic acid, diethyl ester	8060 8270	5. 10.
O,O-Diethyl O-2-pyrazinyl phosphorothioate; Thionazin Dimethoate	297-97-2 60-51-5	Phosphorothioic acid, O,O-diethyl O-pyrazinyl ester Phosphorodithioic acid, O,O-dimethyl S-[2-(methylamino)- 2-oxoethyl] ester	8270 8270	10. 10.
p-(Dimethylamino)azobenzene	60-11-7	Benzenamine, N,N-dimethyl-4- (phenylazo)-	8270	10.
7,12-Dimethylbenz[a]anthracene	57-97-6	Benzo[a]anthracene, 7,12-dimethyl-	8270	10.
3,3'-Dimethylbenzidine	119-93-7	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dimethyl-	8270	10.
alpha, alpha- Dimethylphenethylamine	122-09-8	Benzeneethanamine, alpha, alpha- dimethyl-	8270	10.
2,4-Dimethylphenol	105-67-9	Phenol, 2,4-dimethyl-	8040 8270	5. 10.
Dimethyl phthalate	131-11-3	1,2-Benzenedicarboxylic acid, dimethyl ester	8060 8270	5. 10.
m-Dinitrobenzene	99-65-0	Benzene, 1,3-dinitro-	8270	10.
4,6-Dinitro-o-cresol	534-52-1	Phenol, 2-methyl-4,6-dinitro-	8040 8270	150. 50.
2,4-Dinitrophenol	51-28-5	Phenol, 2,4-dinitro-	8040 8270	150. 50.
2,4-Dinitrotoluene	121-14-2	Benzene, 1-methyl-2,4-dinitro-	8090 8270	0.2 10.
2,6-Dinitrotoluene	606-20-2	Benzene, 2-methyl-1,3-dinitro-	8090 8270	0.1 10.
Dinoseb; DNBP; 2-sec-Butyl- 4,6-dinitrophenol	88-85-7	Phenol, 2-(1-methylpropyl)-4,6- dinitro-	8150 8270	1. 10.
Di-n-octyl phthalate	117-84-0	1,2-Benzenedicarboxylic acid, dioctyl ester	8060 8270	30. 10.

## Appendix 1 List Table 4-1 (con't)

Common Name	CAS RN	Chemical Abstracts Service Index Name	Suggested Methods	POI (ug/L)
1,4-Dioxane	123-91-1	1,4-Dioxane	8015	150.
Diphenylamine	122-39-4	Benzeneamine, N-phenyl-	8270	10.
Disulfoton	298-04-4	Phosphorodithioic acid, O,O-diethyl S-[2-(ethylthio)ethyl] ester	8140	2.
			8270	10.
Endosulfan I	959-98-8	6,9-Methano-2,4,3-benzodioxathiepin, 6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-, 3-oxide (3alpha, 5abeta, 6alpha, 9alpha, 9abeta)-	8080	0.1
			8250	10.
Endosulfan II	33213-65-9	6,9-Methano-2,4,3-benzodioxathiepin, 6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-, 3-oxide (3alpha, 5alpha, 6beta, 9beta, 9alpha)-	8080	0.05
Endosulfan sulfate	1031-07-8	6,9-Methano-2,4,3-benzodioxathiepin, 6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-, 3,3-dioxide	8080	0.5
Endrin	72-20-8	2,7,3,6-Dimethanonaphth[2,3-b]oxirene, 3,4,5,6,9,9-hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-, (1alpha, 2beta, 2abeta, 3alpha, 6alpha, 6abeta, 7beta, 7alpha)-	8080	0.1
			8250	10.
Endrin aldehyde	7421-93-4	1,2,4-Methanocyclopenta[cd]pentalene-5-carboxaldehyde, 2,2a,3,3,4,7-hexachlorodecahydro-, (1alpha, 2beta, 2abeta, 4beta, 4abeta, 5beta, 6abeta, 6bbeta, 7R)-	8080	0.1
			8270	10.
Ethylbenzene	100-41-4	Benzene, ethyl-	8020	2.
Ethyl methacrylate	97-63-2	2-Propenoic acid, 2-methyl-, ethyl ester	8240	5.
			8015	10.
			8240	5.
Ethyl methanesulfonate	62-50-0	Methanesulfonic acid, ethyl ester	8270	10.
Feniphur	52-85-7	Phosphorothioic acid, O-[4-[(dimethylamino)sulfonyl]phenyl]-O,O-dimethyl ester	8270	10.
			8270	10.
Fluoranthene	206-44-0	Fluoranthene	8100	200.
			8270	10.
Fluorene	86-73-7	9H-Fluorene	8100	200.
			8270	10.
Heptachlor	76-44-8	4,7-Methano-1H-indene, 1,4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-2,3-Methano-2H-indeno[1,2-b]oxirene, 2,3,4,5,6,7,7-heptachloro-1a,1b,5,5a,6,6a-hexahydro- (1alpha, 1bbeta, 2alpha, 3alpha, 5abeta, 6beta, 6alpha)-	8080	0.05
			8270	10.
Heptachlor epoxide	1024-57-3	2,3-Methano-2H-indeno[1,2-b]oxirene, 2,3,4,5,6,7,7-heptachloro-1a,1b,5,5a,6,6a-hexahydro- (1alpha, 1bbeta, 2alpha, 3alpha, 5abeta, 6beta, 6alpha)-	8080	1.
			8270	10.
Hexachlorobenzene	118-74-1	Benzene, hexachloro-	8120	0.5
			8270	10.
Hexachlorobutadiene	87-68-3	1,3-Butadiene, 1,1,2,3,4,4-hexachloro-	8120	5.
			8270	10.
Hexachlorocyclopentadiene	77-47-4	1,3-Cyclopentadiene, 1,2,3,4,5,5-hexachloro-	8120	5.
			8270	10.
Hexachloroethane	67-72-1	Ethane, hexachloro-	8120	0.5
			8270	10.
Hexachlorophene	70-30-4	Phenol, 2,2'-methylenebis[3,4,6-trichloro-	8270	10.
Hexachloropropene	1888-71-7	1-Propene, 1,1,2,3,3,3-hexachloro-	8270	10.
2-Hexanone	591-78-6	2-Hexanone	8240	50.
Indeno (1,2,3-cd)pyrene	193-39-5	Indeno[1,2,3-cd]pyrene	8100	200.
			8270	10.
Isobutyl alcohol	78-83-1	1-Propanol, 2-methyl-	8015	50.
Isodrin	465-73-6	1,4,5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro- (1alpha, 4alpha, 4abeta, 5beta, 8beta, 8abeta)-	8270	10.
Isophorone	78-59-1	2-Cyclohexen-1-one, 3,5,5-trimethyl-	8090	60.
Isosafrole	120-58-1	1,3-Benzodioxole, 5-(1-propenyl)-	8270	10.
			8270	10.

# Appendix I List Table 4-1 (con't)

Common Name	CAS RN	Chemical Abstracts Service Index Name	Suggested Method	PCF (ug/L)
Kepons	143-50-0	1,3,4-Metheno-2H-cyclobuta-(c,d)pentalen-2-one, 1,1a,3,3a,4,5,5a,5b,6-decachlorooctahydro-	8270	10.
Lead	(Total)	Lead	6010	40.
			7420	1000.
			7421	10.
Mercury	(Total)	Mercury	7470	2.
Methacrylonitrile	126-96-7	2-Propenenitrile, 2-methyl-	8015	5.
			8240	5.
Methapyrilene	91-80-5	1,2-Ethanediamine, N,N-dimethyl-N'-2-pyridinyl-N'-(2-thienylmethyl)-	8270	10.
Methoxychlor	72-43-5	Benzene, 1,1'-(2,2,2-trichloroethylidene)bis (methoxy-	8080	5.
Methyl bromide; Bromoethane	74-83-9	Methane, bromo-	8270	10.
			8010	20.
Methyl chloride; Chloromethane	74-87-3	Methane, chloro-	8240	10.
			8010	10.
3-Methylcholanthrene	56-49-5	Benz[ <i>a</i> ]acanthrylene, 1,2-dihydro-3-methyl-	8240	10.
			8270	10.
Methylene bromide; Dibromomethane	74-95-3	Methane, dibromo-	8010	5.
			8240	5.
Methylene chloride; Dichloromethane	75-09-2	Methane, dichloro-	8010	10.
			8240	10.
Methyl ethyl ketone; MEK	78-93-3	2-Butanone	8015	10.
			8240	100.
Methyl iodide; Iodomethane	74-88-4	Methane, iodo-	8010	40.
			8240	5.
Methyl methacrylate	80-62-6	2-Propenoic acid, 2-methyl-, methyl ester	8015	5.
			8240	5.
Methyl methanesulfonate	66-27-3	Methanesulfonic acid, methyl ester	8270	10.
2-Methylnaphthalene	91-57-6	Naphthylene, 2-methyl-	8270	10.
Methyl parathion; Parathion methyl	298-00-0	Phosphorothioic acid, O,O-dimethyl O-(4-nitrophenyl) ester	8140	0.5
			8270	10.
4-Methyl-2-pentanone; Methyl isobutyl ketone	108-10-1	2-Pentanone, 4-methyl-	8015	5.
Naphthalene	91-20-3	Naphthalene	8240	50.
			8100	200.
1,4-Naphthoquinone	130-15-4	1,4-Naphthalenedione	8270	10.
1-Naphthylamine	134-32-7	1-Naphthalenamine	8270	10.
2-Naphthylamine	91-59-8	2-Naphthalenamine	8270	10.
Nickel	(Total)	Nickel	8270	10.
			6010	30.
			7520	400.
n-Nitroaniline	88-74-4	Benzenamine, 2-nitro-	8270	30.
m-Nitroaniline	99-09-2	Benzenamine, 3-nitro-	8270	30.
p-Nitroaniline	100-01-6	Benzenamine, 4-nitro-	8270	30.
Nitrobenzene	98-95-3	Benzene, nitro-	8090	40.
			8270	10.
o-Nitrophenol	88-75-5	Phenol, 2-nitro-	8040	5.
			8270	10.
p-Nitrophenol	100-02-7	Phenol, 4-nitro-	8040	10.
			8270	50.
4-Nitroquinoline 1-oxide	56-57-5	Quinoline, 4-nitro-, 1-oxide	8270	10.
N-Nitrosodi-n-butylamine	924-16-3	1-Butanamine, N-butyl-N-nitroso-	8270	10.
N-Nitrosodiethylamine	55-18-5	Ethanamine, N-ethyl-N-nitroso-	8270	10.
N-Nitrosodimethylamine	62-75-9	Methanamine, N-methyl-N-nitroso-	8270	10.
N-Nitrosodiphenylamine	86-30-6	Benzenamine, N-nitroso-N-phenyl-	8270	10.
N-Nitrosodipropylamine; Di-n-propylnitrosamine	621-64-7	1-Propanamine, N-nitroso-N-propyl-	8270	10.
N-Nitrosomethylethylamine	10995-95-6	Ethanamine, N-methyl-N-nitroso-	8270	10.
N-Nitrosomorpholine	59-89-2	Morpholine, 4-nitroso-	8270	10.
N-Nitrosopiperidine	100-75-4	Piperidine, 1-nitroso-	8270	10.
N-Nitrosopyrrolidine	930-55-2	Pyrrolidine, 1-nitroso-	8270	10.
5-Nitro-o-toluidine	99-55-8	Benzenamine, 2-methyl-5-nitro-	8270	10.
Parathion	56-38-2	Phosphorothioic acid, O,O-diethyl-O-(4-nitrophenyl) ester	8270	10.
			8080	50.
Polychlorinated biphenyls; PCBs	See (g)	1,1'-Biphenyl, chloro derivatives	8250	100.
			8280	0.01
Polychlorinated dibenzo-p-dioxins; PCDDs	See (h)	Dibenzo(b,e)[1,4]dioxin, chloro derivatives	8280	0.01
Polychlorinated dibenzofurans; PCDFs	See (i)	Bibenzofuran, chloro derivatives	8280	0.01



Appendix 1 List Table 4-1 (con't)

Common Name	CAS RN	Chemical Abstracts Service Index Name	Suggested Methods	POL (ug/L)
Pentachlorobenzene	608-93-5	Benzene, pentachloro-	8270	10.
chloromethane	76-01-7	Ethane, pentachloro-	8240	5.
chloronitrobenzene	82-68-8	Benzene, pentachloronitro-	8270	10.
Pentachlorophenol	87-86-5	Phenol, pentachloro-	8270	10.
Phenacetin	62-44-2	Acetamide, N-(4-ethoxyphenyl)	8270	50.
Phenanthrene	85-01-8	Phenanthrene	8100	10.
Phenol	108-95-2	Phenol	8270	10.
p-Phenylenediamine	106-50-3	1,4-Benzenediamine	8270	10.
Phosgene	298-02-2	Phosphorodithioic acid, O,O-diethyl S-[(ethylthio)methyl] ester	8140	2.
2-Picoline	109-06-8	Pyridine, 2-methyl-	8270	10.
Propanamide	23950-58-5	Benzamide, 3,5-dichloro-N-(1,1-dimethyl-2-propenyl)-	8240	5.
Propionitrile; Ethyl cyanide	107-12-0	Propenenitrile	8270	10.
Pyrene	129-00-0	Pyrene	8015	60.
Pyridine	110-86-1	Pyridine	8240	5.
Safrole	94-59-7	1,3-Benzodioxole, 5-(2-propenyl)-	8270	10.
Selenium	(Total)	Selenium	6010	750.
Silver	(Total)	Silver	7740	20.
Silvex; 2,4,5-TP	93-72-1	Propanoic acid, 2-(2,4,5-trichlorophenoxy)-	7741	20.
Styrene	100-42-5	Benzene, ethenyl-	6010	70.
Sulfide	18496-25-8	Sulfide	7760	100.
T; 2,4,5-chlorophenoxyacetic acid	93-76-5	Acetic acid, (2,4,5-trichlorophenoxy)-	8150	2.
2,3,7,8-TCDD; 2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-8	Dibenzo(h,e)l[1,4]dioxin, 2,3,7,8-tetrachloro-	8020	1.
1,2,4,5-Tetrachlorobenzene	95-94-3	Benzene, 1,2,4,5-tetrachloro-	8240	5.
1,1,1,2-Tetrachloroethane	630-20-6	Ethane, 1,1,1,2-tetrachloro-	9030	1000.
1,1,2,2-Tetrachloroethane	79-34-5	Ethane, 1,1,2,2-tetrachloro-	8150	2.
Tetrachloroethylene;	127-18-4	Ethene, tetrachloro-	8280	0.005
Perchloroethylene;			8270	10.
Tetrachloroethene			8010	5.
2,3,4,6-Tetrachlorophenol	58-90-2	Phenol, 2,3,4,6-tetrachloro-	8240	5.
Tetraethyl dithiopyrophosphate; Sulfotep	3689-24-5	Phenol, 2,3,4,6-tetrachloro-((HO) <sub>2</sub> P(S)) <sub>2</sub> O, tetramethyl ester	8010	0.5
Thallium	(Total)	Thallium	8240	5.
Tin	(Total)	Tin	6010	400.
Toluene	108-88-3	Benzene, methyl-	7840	1000.
o-Toluidine	95-53-4	Benzenamine, 2-methyl-	7841	10.
Toxapiene	8001-35-2	Toxapiene	7870	8000.
1,2,4-Trichlorobenzene	120-82-1	Benzene, 1,2,4-trichloro-	8020	2.
1,1,1-Trichloroethane; Methyl chloroform	71-55-6	Ethane, 1,1,1-trichloro-	8240	5.
1,1,2-Trichloroethane	79-01-5	Ethane, 1,1,2-trichloro-	8240	5.
Trichloroethylene;	79-01-6	Ethene, trichloro-	8250	10.
Trichloroethene			8270	10.
Trichlorofluoromethane	75-69-4	Methane, trichlorofluoro-	8240	5.
2,4-Trichlorophenol	95-94-4	Phenol, 2,4,5-trichloro-	8010	10.
2,4,6-Trichlorophenol	88-06-2	Phenol, 2,4,6-trichloro-	8240	5.
			8270	10.

Common Name	CAS RN	Chemical Abstracts Service Index Name	Suggested Methods	PCOL (ug/L)
1,2,3-Trichloropropane	96-18-4	Propane, 1,2,3-trichloro-	8010	10.
0,0,0-Triethyl phosphorothioate	126-68-1	Phosphorothioic acid, 0,0,0-triethyl ester	8240	5.
sym-Trinitrobenzene	99-35-4	Benzene, 1,3,5-trinitro-	8270	10.
Vanadium	(Total)	Vanadium	8270	10.
Vinyl acetate	108-05-4	Acetic acid, ethenyl ester	6010	80.
Vinyl chloride	75-01-4	Ethene, chloro-	7910	2000.
Xylene (total)	1330-20-7	Benzene, dimethyl-	7911	40.
Zinc	(Total)	Zinc	8240	5.
			8010	2.
			8240	10.
			8020	5.
			8240	5.
			6010	20.
			7930	30.

(Source: Added in R87-39 at 12 Ill. Reg. 13135, effective July 29, 1988; amended in R88-16 at 13 Ill. Reg. 458, effective December 21, 1988)

Table 4-1 (con't)

APPENDIX I FOOTNOTES

- a) The regulatory requirements pertain only to the list of substances; the right hand columns (Methods and PQL) are given for informational purposes only. See also (e) and (f).
- b) Common names are those widely used in government regulations, scientific publications and commerce; synonyms exist for many chemicals.
- c) "CAS RN" means "Chemical Abstracts Service Registry Number". Where "total" is entered, all species in the groundwater that contain this element are included.
- d) CAS index names are those used in the 9th Cumulative index.
- e) "Suggested Methods" refer to analytical procedure numbers used in "Test Methods for Solid Waste", incorporated by reference in 35 Ill. Adm. Code 720.111. Analytical details can be found in "Test Methods", and in documentation on file with USEPA. Caution: The methods listed are representative procedures and may not always be the most suitable methods for monitoring an analyte under the regulations.
- f) Practical Quantitation Limits ("PQLs") are the lowest concentrations of analytes in groundwater that can be reliably determined within specified limits of precision and accuracy by the indicated methods under routine laboratory operating conditions. The PQLs listed are generally stated to one significant figure. Caution: The PQL values in many cases are based only on a general estimate for the method and not on a determination for individual compounds; PQLs are not a part of the regulation.
- g) PCBs (CAS RN 1336-36-3). This category contains congener chemicals, including constituents Aroclor-1016 (CAS RN 12674-11-2), Aroclor-1221 (CAS RN 11104-28-2), Aroclor-1232 (CAS RN 11141-16-5), Aroclor-1242 (CAS RN 53469-21-9), Aroclor-1248 (CAS RN 12672-29-6), Aroclor-1254 (CAS RN 11097-69-1) and Aroclor-1260 (CAS RN 11096-82-5). The PQL shown is an average value for PCB congeners.
- h) PCDDs. This category includes congener chemicals, including tetrachlorodibenzo-p-dioxins (see also 2,3,7,8-TCDD), pentachlorodibenzo-p-dioxins and hexachlorodibenzo-p-dioxins. The PQL shown is an average value for PCDD congeners.
- i) PCDFs. This category contains congener chemicals, including tetrachlorodibenzofurans, pentachlorodibenzofurans and hexachlorodibenzofurans. The PQL shown is an average for all PCDF congeners.

The constituent list, based upon the groundwater assessment monitoring information, will form the initial basis for monitoring consistent with 35 IAC 724.197(g) and (h). The list will be re-evaluated based upon Appendix I parameters which have been proved to have a statistically significant increase. Any reported constituent not already identified as a monitoring constituent, will be verified through resampling within 30 days after receipt of the analytical data, to repeat the analyses of the specific constituents identified in the Appendix I analyses. If the second analyses confirms the presence of new constituents, the monitoring list shall be modified and the results reported to the Agency with the quarterly groundwater monitoring report. If resampling is not conducted, the additional constituents will be reported to the Agency and added to the monitoring list. The concentration limits for each constituent having a standard in 35 IAC Part 620, will be that standard promulgated in 35 IAC Part 620. If a constituent exceeds the standard, an alternate concentration limit may be established.

The pesticides 4,4'-DDT and 4,4'-DDE have been deleted from the monitoring list based upon the laboratory finding that these constituents were also found in the QC blank. This finding was made by the laboratory regarding the April 30, 1987 Appendix I samples. This determination is attached as Appendix 5 and has been made available to the Agency as part of the groundwater monitoring data base for the groundwater assessment monitoring program.

In order to provide a general indication of groundwater quality, pH, temperature, and specific conductance will be measured in the field during each sampling event. Depth-to-water measurements will also be made on each groundwater monitoring well prior to sampling. This information will enable groundwater elevation contour maps to be constructed for evaluation of groundwater flow direction, which is required on an annual basis.

Additionally, the water level data for Lake Calumet will be part of the data included in the quarterly reports.

#### 4.4 Analysis Plan

##### 4.4.1 Laboratory Quality Control Procedures

The protocol for percentage of quality assurance samples, the instrumental quality control, the extraction logs, the methodology steps, the use of reagents and preparation, etc., will meet EPA analytical quality control criteria. This information, as well as the procedures for handling of all samples and information regarding the personnel involved, is documented in the WMI Environmental Monitoring Laboratories, Inc. (EML) Quality Assurance Plan. A complete quality assurance report is available from the EML, upon request, for any particular sampling event.

Laboratory personnel examine the seal on the shipping container upon arrival, break the seal, record sample temperature, and sign the Field Chain-of-Custody Record. Each labeled sample bottle is stored in a secured area or provided to an analyst or technician. This information, as well as the movement of the sample throughout the laboratory, is recorded.

#### 4.4.2 Reporting Limits

The quantification limits of the constituents analyzed for in the groundwater will be those which are achievable with the best available technology or as specified in 35 IAC 620.510(b)(3). Reporting limits utilized for each parameter are identified on the analytical reports provided by the laboratory.

#### 4.4.3 Analytical Methodologies

Table 4-2 presents the standard methodologies used for each parameter (or group of parameters) required in the CWMCS facility monitoring program. All methods are EPA approved.

#### 4.4.4 Reporting Requirements

The results of groundwater monitoring will be submitted to the IEPA quarterly. The statistical comparisons will be submitted to the IEPA quarterly and new statistics will be computed annually.

TABLE 4-2

CWM CHEMICAL SERVICES, INC.  
CHICAGO INCINERATOR FACILITY

## METHODOLOGY FOR TESTING AND ANALYSIS

<u>Parameter</u>	<u>EPA Reference Method</u>
<b>Acid/Base/Neutral</b>	625 <sup>3</sup> /8270 <sup>4</sup>
1,2-Dichlorobenzene	
2,4-Dichlorophenol	
2,4-Dimethylphenol	
2,6-Dichlorophenol	
2-Chlorophenol	
3-Methylphenol (m-cresol)	
4-Chloroaniline	
4-Methylphenol (p-cresol)	
Aniline	
Anthracene	
Naphthalene	
Phenol	
<b>Metals (total and dissolved)</b>	
Aluminum	200.7 <sup>1</sup> /6010 <sup>4</sup>
Arsenic	206.2 <sup>1</sup> /7060 <sup>4</sup>
Barium	200.7 <sup>1</sup> /6010 <sup>4</sup>
Cadmium	200.7 <sup>1</sup> /6010 <sup>4</sup>
Chromium	200.7 <sup>1</sup> /6010 <sup>4</sup>
Iron	200.7 <sup>1</sup> /6010 <sup>4</sup>
Lead	200.7/600
Sodium	200.7 <sup>1,3</sup> /6010 <sup>4</sup>
Zinc	200.7 <sup>1</sup> /6010 <sup>4</sup>
<b>Inorganics</b>	
Chloride	325.1 <sup>1</sup>
Fluoride	340.2 <sup>1</sup>

TABLE 4-2 (con't)

CWM CHEMICAL SERVICES, INC.  
CHICAGO INCINERATOR FACILITY

## METHODOLOGY FOR TESTING AND ANALYSIS

<u>Parameter</u>	<u>EPA Reference Method</u>
VOAs	8260 <sup>4</sup> /8240 <sup>4</sup> /602 <sup>2</sup> /624 <sup>3</sup>
Xylene (meta, para, ortho) <sup>6</sup>	
1,1-Dichloroethene	
Acetone	
Benzene	
Chlorobenzene	
Dichlorodifluoromethane	
Ethylbenzene	
Methylene Chloride	
Toluene	
Acetonitrile	
Ethyl Cyanide	
Methyl Ethyl Ketone	
1,1,2-Trichloroethane	
Methyl Isobutyl Ketone	
Vinyl Chloride	8260 <sup>4,5</sup>
p-Dioxane	8260 <sup>4</sup> /8240 <sup>4</sup> /624 <sup>3</sup>
Appendix I constituents	See Table 4-1

Notes:

- <sup>1</sup> "Methods for Chemical Analysis of Water and Wastes", EMSL-EPA; March, 1983.
- <sup>2</sup> "Standard Methods for the Examination of Water and Wastewater", 16th Edition 1985.
- <sup>3</sup> "Methods of Organic Chemical Analysis of Municipal and Industrial Wastewaters" EPA-600/4-82-057, July 1982.
- <sup>4</sup> "Test Methods for Evaluating Solid Waste", SW846 Third Edition; September, 1986; USEPA
- <sup>5</sup> This method requires a sample size of 25 ml to yield a PQL of 2 ug/l.
- <sup>6</sup> Statistics will be based in combined results.



#### 4.4.5 Recordkeeping Requirements

This document, as well as the analytical results for each sampling event and each production of the required statistical tests, will be kept on-site until final facility closure.

Following closure, this plan and all analytical results may be kept on-site or at CWM Corporate offices. The accumulation of these items meets all applicable recordkeeping requirements.

#### State Recordkeeping Requirements

The following information is required to be kept on-site (except as described above) and available for inspection:

- o Documentation of the groundwater monitoring system capability.
- o Documentation of the integrity of the groundwater monitoring wells.
- o Demonstration of any groundwater monitoring waivers or approvals of any alternative groundwater monitoring system.
- o Description of the groundwater sampling and analysis plan.
- o Detection and/or groundwater assessment program records.

## 5.0 DATA EVALUATION PROCEDURES

Analytical data will be evaluated statistically to detect potential impacts of the regulated unit (surface impoundments) on groundwater quality. Groundwater elevation data will be evaluated to identify changes in the direction of groundwater flow. Water levels of Lake Calumet will be interpreted to support this evaluation.

### 5.1 Statistical Evaluation Procedures

Not all of the constituents identified in Table 4-1 have been detected in each of the post-closure monitoring wells. Some constituents have a groundwater quality standard under 35 IAC Part 620. Therefore, three statistical methodologies will be employed; one for constituents that have been reported routinely detected in the groundwater assessment monitoring program but for which there is no existing groundwater quality standard (Case I); a second for constituents not reported routinely in the groundwater assessment monitoring program and for which there is no existing groundwater quality standard (Case II); and a third for constituents which have a groundwater quality standard, which have been detected, and do not currently exceed the standard (Case III).

The first method, for constituents which routinely have been detected in the groundwater, will utilize intra-well comparisons of future measurements for each groundwater monitoring well using a prediction limit methodology. The second method, which will be used for those constituents not previously detected in groundwater assessment monitoring, will utilize statistically derived practical quantitation limit (PQL) values (2

times the PQL). The third method will assure new exceedances of groundwater protection standards are responded to in a timely manner irrespective of statistical changes.

Statistical evaluations will be conducted on a quarterly basis. Background groundwater quality upgradient from the surface impoundments and at the facility boundary will also be evaluated. The evaluation will use the designated upgradient groundwater monitoring wells, to ascertain whether alternate statistics or other changes to the monitoring program are necessary due to regional changes, off-site activities, or water level fluctuations. Monitoring wells G307S, G334S and G343S are designated as the upgradient facility boundary groundwater monitoring wells. Monitoring well G123S is designated as a groundwater monitoring well immediately upgradient to the surface impoundments.

#### Background Determinations

The historical groundwater monitoring data for this facility, coupled with the unusual geological and hydrogeological characteristics of the site, clearly indicate that upgradient monitoring cannot be used for comparison to downgradient groundwater monitoring wells. In addition, inherent spatial variability and known on-site contamination upgradient of the surface impoundments, diminish the effectiveness of statistical comparisons of upgradient and downgradient measurements. Therefore, an intra-well comparison methodology is recommended.

Intra-well comparisons will be used to statistically evaluate parameters which have been detected historically, namely using a prediction limit methodology. Existing baseline data for each groundwater monitoring well will be used to construct the well-specific prediction limits for each parameter.

In essence, either a prediction limit or a PQL will be utilized. In the event that monitoring parameter groundwater quality data are below the reporting limit, the PQL for that parameter will be used in the statistical analysis of that parameter. The appropriate method will be utilized for each parameter based upon reported background data for each groundwater monitoring well, for that parameter. The Case I method is utilized for a constituent from a particular groundwater monitoring well, when all samples are routinely reported to contain detectable concentrations of that constituent. The Case II method is utilized for a constituent which has not historically been detected. The Case III Method is utilized for those constituents which have a groundwater quality standard, which have been detected, and do not currently exceed the standard as listed in 35 IAC 620.

#### **Case I: Statistical Method**

The statistical method recommended for this facility is the prediction limit procedure (as described by Gibbons, 1987 and Gibbons and Baker, 1991). For parameters that are above detection and are reported routinely, the prediction limit (Gibbons, 1987) will be

used to calculate a localized "background". This statistical test has been approved by USEPA in the revised statistical rule for RCRA facilities (53 FR 39720).

The prediction limit also is described by Guttman (1970) and describes the relationship of each individual new measurement to the calculated interval based on background data. The statistical tests account for variability in the background data and establish an upper limit. Each new monitoring result is compared to this limit. The prediction limit also provides an equal balance between the false negative and the false positive results.

Data will be collected for two (2) years to establish background, to provide a reasonable idea of the seasonal effects on groundwater quality, water table fluctuations and to develop site-specific quantification levels in lieu of PQLs. Historical data have indicated that obtaining analytical results where there are matrix interferences requiring dilution make consistent achievement of the PQLs difficult at this facility. The eight background samples will provide enough degrees of freedom to yield a prediction limit formula of  $\bar{x} + 3.16s$  where  $\bar{x}$  is the mean of 8 background samples and  $s$  is the standard deviation. This formula closely resembles the QA/QC practice of commercial labs that use 3 standard deviations to determine if data are within acceptable limits. The 3.16 factor is derived from statistical tables that compare the number of background samples (8) to the number of new observations ( $K=1$ ) at the one-sided, 99 percent prediction limit. The statistical results for the metals will be based upon the dissolved results.

The prediction limit (PL) will be initially based upon the previous two (2) years of data and be defined as follows:

$$PL = \text{mean} + 3.16 \times \text{standard deviation}$$

This method will be valid for all parameters with detectable and quantifiable levels. The prediction limits will be established for each parameter specific to each groundwater monitoring well. Exceedance of the prediction limit during a quarterly sampling event, along with a confirmatory sampling event, will be considered statistically significant.

The limit will be reviewed and updated every year unless upgradient results indicate that this limit would not be indicative of changes in the results for this groundwater monitoring well or determinations pursuant to 35 IAC 724.199(i) are made.

#### **Case II: Statistical Method**

Each groundwater monitoring well for which a constituent is not routinely reported, when compared to the PQL established for that constituent, shall be compared to the PQL. A statistically significant exceedance will be defined as a constituent concentration greater than two (2) times the PQL, or as a reported concentration of two or more of these constituents being greater than their PQL.

Initially, PQL's will be based upon SW-846 (Third Edition) levels or pursuant to 35 IAC 620.510(b). For parameters that have matrix interference, for which dilution is required, "site-specific" practical quantitation limits (PrQLs) will be developed. The PrQLs are based on the sources of analytical variability that are inherent in routine laboratory practice. Each facility is required to use available laboratory data to determine PrQLs that take into consideration "the lowest concentration level data that can be reliably achieved within specified limits of precision and accuracy during routine laboratory conditions" (see 53 FR 39720, dated October 11, 1988).

### **Case III: Exceedance Method**

Each point of compliance groundwater monitoring well which has detected a constituent which has a groundwater protection standard and that value has exceeded the standard listed in 35 IAC 620 (see Section 6.0), will trigger the procedures of 35 IAC 724.199(h) unless provided for otherwise.

### **5.2 Verification Monitoring**

If a reported parameter value indicates a statistically significant increase, a resample will be taken from the groundwater monitoring well being evaluated. This verification monitoring will take place within 30 days of receipt of the analytical results. Confirmation of the analytical results which indicated the statistically significant increase will be the basis for proceeding with activities pursuant to 35 IAC Section 724.199(h).

**References:**

1. Gibbons, R.D. (1987), "Statistical Prediction Intervals for the Evaluation of Groundwater Quality", Ground Water 25, pp. 455-465.
2. Gibbons, R.D. and Baker, J.A., (1991), "The Properties of Various Statistical Prediction Intervals for Ground-Water Detection Monitoring", Environmental Science and Health A26(4), pp. 535-553.
3. Guttman, I. (1970), Statistical Tolerance Regions: Classical and Bayesian, Hoffner, Darien, Connecticut.



groundwater yield of 150 gallons/day. Figure 2-3 identifies that the geologic material has hydraulic conductivities of  $10^{-8}$  cm/sec.

According to 35 IAC 620.420, the facility groundwater monitoring program monitors groundwaters which are classified as Class II: General Resource Groundwater. Therefore, the inorganic chemical constituents monitored by the CWMCS monitoring program, except due to natural causes, must not exceed the following concentrations:

<u>Constituent</u>	<u>Standard (mg/L)</u>
Arsenic	0.2
Barium	2*
Cadmium	0.05
Chromium	1
Cobalt	1
Cyanide	0.6
Fluoride	4.0
Lead	0.1
Mercury	0.01
Nitrate as N	100
pH	6.5-9*
Boron	2.0*
Chloride	200*
Copper	0.65*
Iron	5*
Manganese	10*
Nickel	2*
Selenium	0.05*
Total Dissolved Solids (TDS)	1200*
Sulfate	400*
Zinc	10*

\* exempted pursuant to 35 IAC 620.420(a)(3) at the point of compliance

## 6.1 Compliance Monitoring

### 6.1.1 Statistically Significant Increases

Results of the chemical analyses and statistical comparisons will be reported to the IEPA on a quarterly basis and as part of the annual facility report. The annual report will also include results of the annual background value evaluations, and proposed revised background values, where appropriate. In addition, the annual report will include a determination of the groundwater flow rate and direction and a discussion of results of the annual Appendix I samples.

If CWMCS determines that a statistically significant increase has occurred, pursuant to Section 5.1 of this plan, at a downgradient point of compliance monitoring well during a quarterly sampling event, then CWMCS shall resample the groundwater monitoring well within 30 days of the receipt of the analytical data. Verification of the statistically significant increase would require that procedures specified in 35 IAC 724.199(h) be implemented.

### 6.1.2 Reporting of Statistically Significant Increases

If CWMCS determines pursuant to 35 IAC 724.199(d) that any concentration limits under Section 724.194 or 35 IAC 620.420 are being exceeded at any monitoring well at the point of compliance, CWMCS will notify the Agency of this finding in writing within 7 days and indicate what concentration limits have been exceeded in accordance with 35 IAC 724.199(h)(1).

### 6.1.3

#### Permit Modifications

In accordance with 35 IAC 724.199(h)(2), CWMCS will submit to the Agency an application for a permit modification to establish a corrective action program meeting the requirements of Section 724.200 within 180 days, or within 90 days if an engineering feasibility study has been previously submitted to the Agency under Section 724.198(g)(5). The application will include a detailed description of corrective actions that will achieve compliance with the groundwater protection standard specified in 35 IAC 620.420 and a plan for a groundwater monitoring program that will demonstrate the effectiveness of the corrective action. The groundwater monitoring program will be based on the compliance monitoring program described by this Post-closure Groundwater Monitoring Plan.

If CWMCS determines that the compliance monitoring program no longer satisfies the requirements of 35 IAC 724.199, CWMCS will submit an application for a permit modification to make any appropriate changes to the program within 90 days of that determination.

### 6.1.4

#### Demonstrations

If CWMCS determines, pursuant to 35 IAC 724.199(d), that the groundwater concentration limits under 35 IAC 724.199 are being exceeded at any monitoring well at the point of compliance, CWMCS may demonstrate that a source other than a regulated unit caused the contamination or that the detection is an artifact caused by an

error in sampling, analysis or statistical evaluation, or natural variation in groundwater.

In making a demonstration under 35 IAC 724.199, CWMCS will notify the Agency in writing within seven days that it intends to make a demonstration under 35 IAC 724.199(i). Within 90 days, CWMCS will submit a report to the Agency which demonstrates that a source other than a regulated unit caused the standard to be exceeded or that the apparent noncompliance with the standards resulted from error in sampling, analysis or evaluation. Also within 90 days, CWMCS will submit to the Agency an application for a permit modification to make any appropriate changes to the compliance monitoring program at the facility. CWMCS will continue to monitor in accord with the compliance monitoring program established in this document, until approval is received from the Agency.

## 6.2 Corrective Action

Pursuant to 35 IAC 724.201, CWMCS will institute corrective action as necessary to protect human health and the environment for all releases of hazardous waste or constituents from any solid waste management unit at the facility, regardless of the time at which waste was placed in the unit. This corrective action plan will include a schedule for corrective actions, financial responsibility for completing corrective actions and corrective measures beyond the property boundary, where necessary, to protect human health and the environment.

### 6.2.1 Implementation

If required to establish a corrective action program, CWMCS will take corrective action to ensure that regulated units are in compliance with the groundwater protection standard under 35 IAC 724.192 and 35 IAC 620.420 and as specified in the facility permit. The corrective action plan will include a characterization of the contaminated groundwater, including concentrations of hazardous constituents detected and other factors given in 35 IAC 703.185(g). The Corrective Measures Study of the RFI will be utilized to satisfy the requirement for an engineering feasibility study pursuant to 35 IAC 703.185(g). CWMCS will implement a closure plan that will prevent hazardous constituents from exceeding their respective concentration limits at the compliance point by treating them in place.

The overall facility compliance issues will be addressed with the RFI process. If a determination has been made that a constituent does not pose a substantial hazard, an alternate concentration limit may be established for the corrective action program. In determining whether a constituent will pose a substantial hazard or not, potentially adverse effects of the constituents on groundwater quality and on hydraulically connected surface water quality will be considered.

CWMCS will begin corrective action within a reasonable time period after the groundwater protection standard is exceeded, in accordance with Agency approvals. In conjunction with the corrective action program, CWMCS will establish and implement a groundwater monitoring program to demonstrate the effectiveness of the corrective action program.

### 6.2.2

#### Corrective Action Program

In addition to the other requirements of 35 IAC 724.200, CWMCS will assure that any corrective action program under this section is consistent with the RFI, and provides for removal or treatment in place of any hazardous constituents under 35 IAC 724.193 that exceed applicable concentration limits under 35 IAC 724.194 and 35 IAC 620.420. These corrective action measures must take place between the point of compliance and the downgradient facility boundary, or beyond the facility boundary where necessary to protect human health and the environment. Detailed plans and an engineering report describing the corrective action to be taken must be included in the corrective action plan if appropriate. Included with the detailed plans, provisions for specific operations and maintenance schedules needed to achieve compliance limits will be provided. If corrective action is needed beyond the facility boundary, a description and summary of any additional hydrogeologic data pertaining to the effectiveness of the corrective action must be included with the plan. Since the surface impoundments will be closed in-place, a post-closure care plan will be part of the corrective action plan.

CWMCS will continue corrective action measures during the compliance period to the extent necessary to ensure that the groundwater protection standard is not exceeded. If CWMCS is conducting corrective action at the end of the compliance period, then CWMCS will continue that corrective action for as long as necessary to achieve compliance with the groundwater protection standard. CWMCS may terminate corrective action measures taken beyond the period equal to the active life of the waste management

area (including the closure period) if CWMCS can demonstrate, based on data from the groundwater monitoring program under 35 IAC 724.200(d), that the groundwater protection standards of 35 IAC 724.192 and 35 IAC 620.420, have not been exceeded for a period of three consecutive years.

### 6.2.3 Reporting

CWMCS will submit a written report to the Agency which describes the effectiveness of the corrective action program. CWMCS will submit these reports semi-annually. If CWMCS determines that the corrective action program no longer satisfies the requirements of 35 IAC 724.200, CWMCS will, within 90 days, submit an application for a permit modification to make any appropriate changes to the program.



ENVIRONMENTAL SERVICES, INC.

1200 CROWN COLONY DRIVE, P.O. BOX 9137 • QUINCY, MA 02269-9137  
(617) 849-1800

Via Federal Express

February 8, 1995

Mr. Robert Watson, P.E.  
Illinois Environmental Protection Agency  
Division of Land Pollution Control -- #24  
Permit Section  
2200 Churchill Road  
Post Office Box 19276  
Springfield, IL 62794-9276

Re: Clean Harbors of Chicago, Inc.  
Log No. B-16-M-2  
Response to Notice of Deficiency - Section E

Dear Mr. Watson:

Clean Harbors of Chicago, Inc. (CHCI) has prepared and is pleased to submit the enclosed response to the Agency's December 6, 1995 Comments on Section E of CHCI's Request for Class Permit Modification. The permit modification request was made in July 1994 in anticipation of CHCI's acquisition of certain non-incinerator assets located at the CWM Chemical Services, Inc. hazardous waste facility located on property adjacent to the CHCI facility.

This response package includes five (5) copies of a 5-volume set which contains the following:

1. Volume 5A: A new 3-ring binder which contains Appendix E-6 (first of three parts).
2. Volume 5B: A new 3-ring binder which contains Appendix E-6 (first of three parts).
3. Volume 5C: A new 3-ring binder which contains Appendix E-6 (first of three parts).
4. Volume 5D: A new 3-ring binder which contains existing Appendix E-7 (which has moved from its previous position in existing Volume 5) and new Appendices E-8 through E-14. The new appendices contain information being submitted in response to specific IEPA comments; and





Robert Watson, P.E./IEPA  
February 8, 1995  
Page 2

5. A clipped package of loose leaf pages for insertion into binder previously submitted to the Agency. The pages include the following:
- A revised Table of Contents Page 16;
  - A revised Page E-1 and new Page E-1A from the Section E text;
  - A redlined version of Page E-1 showing all edits from previous edition;
  - A copy of the WMI sampling plan for insertion into existing Appendix E-4;
  - Revised Binder Cover Sheets and Side Panels for existing Binder Volumes 1 and 5; and
  - Instructions for the proper insertion of loose leaf materials.

Please note that all revised pages of the text bear the revision date "02/08/95" in the lower right hand corner of each page. In addition, to aid you in your review, CHCI has prepared a separate comment-by-comment response document which includes the IEPA comment, CHCI's response, and a reference to revisions in the Application.

If you have any questions, please do not hesitate to contact me at (617) 849-1800, extension 4473.

Sincerely,

A handwritten signature in cursive script that reads "Paul A. Ahearn".

Paul A. Ahearn  
Manager, Regulatory Compliance

cc: Stephen Pozner, V.P., Compliance and Health & Safety, CHESI  
Anton Martig, USEPA (letter only)

Enclosures

# INSTRUCTIONS FOR INSERTING LOOSE LEAF MATERIALS

1. In Volume 1, replace existing Table of Contents Page 16 with new Page 16 [Revised 02/08/95].
2. In Volume 1, replace existing text page E-1 with revised Page E-1 [Revised 02/08/95] and new Page E-1A [Revised 02/08/95].
3. Remove Section E Text and Tabs from current position in Volume 1 and move to the front of existing Volume 5.
4. Insert new Appendix E-4 (WMI Sampling Plan) into existing tab Section 4 (currently empty) in Volume 5.
5. Remove Appendix E-6 Tab (currently empty) from current position in Volume 5 and move to the front of new Volume 5A.
6. Remove Appendix E-7 Tab and contents from current position in Volume 5 and move to the front of new Volume 5D.
7. Insert new Binder Cover Pages and Side Title Blocks into Volumes 1 and 5.
8. In "Redline" Volume, add edited page Page E-1 [Revised 02/08/95].

**LIST OF APPENDICES (CONTINUED)**

- D-20. Clean Harbors Dwg. No. 2916-M-01: Existing Reactor Vessel Details
- D-21. Chem Clear Dwg. No. 4062-C: Modifications in Effluent Holding Tank
- D-22. Design Details, Waste Storage Tank.
- D-23. Chem Clear Dwg. No. 4034-D: Tank Details Oily Waste Water Pretreatment
- D-24. Professional Engineer (PE) Certification of Assessment of the Integrity of the Existing RCRA-Exempt Tank Systems
- D-25. Professional Engineer (PE) Certification of Assessment of the Integrity of the Approved/Not Yet Constructed Tank Systems
- D-26. Professional Engineer (PE) Certification of Assessment of the Integrity of the Proposed/Modified Tank Containment System
- D-27. Professional Engineer (PE) Assessment and Certification of the Design of Pegasus Tank Processing System
- D-28. Structural Design and Secondary Containment Calculations for Approved/Not Yet Constructed Units
- D-29. Structural Design and Secondary Containment Calculations for Proposed/Modified Tank System
- D-30. Surface Impoundment Waste Codes
- D-31. Surface Impoundment Closure Certification
- D-32. IEPA Closure Certification Approval
- D-33. Survey Plat
- D-34. Surface Impoundment Post-Closure Notice
- D-35. Manufacturer's literature: Enpac Corporation  
"Poly-Spillpallet 3000" Self-Contained Pallets
- D-36. Engineering Drawings and Design Specifications for Bulk Storage Tank Farm (Unit 16)
  
- E-1. Borings Logs and Groundwater Monitoring Well Construction Summaries
- E-2. Groundwater Assessment Program, Fourth Quarter 1991 Report
- E-2A. Groundwater Elevation Data
- E-3. Historical Data By Sampling Location
- E-4. WMI Manual for Groundwater Sampling
- E-5. Laboratory Explanation of Pesticide and Herbicide Detection in April 1987 Event
- E-6. Groundwater Assessment Report, Golder and Associates, 1987
- E-7. Groundwater Monitoring Enhancements Work Plan Report
- E-8. SURFACE IMPOUNDMENT "NO LIQUID MIGRATION" INFORMATION, EXCERPTED FROM APPROVED SURFACE IMPOUNDMENT CLOSURE PLAN AND PROFESSIONAL ENGINEER CERTIFICATION REPORT.
- E-9. GROUNDWATER MONITORING ANALYTICAL RESULTS - THIRD AND FOURTH QUARTER, 1995.
- E-10. CWMCS FIGURES B.2-1, B.2-2A, AND B.2-2B.
- E-11. LIST OF HAZARDOUS WASTES MANAGED IN SURFACE IMPOUNDMENTS
- E-12. SECTION L, CONTINUING RELEASES FROM PERMITTED FACILITIES, TAKEN FROM CWMCS RCRA PART B APPLICATION, JUNE 1992.
- E-13. CWMCS FIGURES L.2-2A AND L.2-2B.
- E-14. BORING LOGS AND GROUNDWATER MONITORING WELL CONSTRUCTION SUMMARIES

**SECTION E  
GROUNDWATER MONITORING**

**E-1 Exemption from Groundwater Protection Requirements 703.185, 724.190(b)**

**E-1c No Migration 724.190(b)(4)**

**E-1c(1) Active/Proposed Hazardous Waste Management Units**

Clean Harbors of Chicago, Inc. (CHCI) does not operate any active underground tanks, waste piles, surface impoundments, land treatment units, or land disposal units.

All active hazardous waste liquid storage and treatment units are within secondary containment units which meet all current design and construction requirements for existing units. All existing container storage areas are equipped with secondary containment systems which meet current design and construction requirements for existing units.

All proposed hazardous waste management units are designed and will be constructed in compliance with the secondary containment requirements of 35 IAC 724 Subpart I (Use and Management of Containers) and 35 IAC 724 Subpart J (Tank Systems).

All existing and proposed hazardous waste units at the facility are/will be NON-LAND BASED TANK AND CONTAINER MANAGEMENT UNITS WHICH ARE equipped with secondary containment devices AND ARE EXEMPT FROM GROUNDWATER MONITORING REQUIREMENTS AND THE "NO LIQUID MIGRATION" DEMONSTRATION REQUIREMENT. As such, CHCI DOES NOT request a waiver from all 35 IAC 724 Subpart F groundwater monitoring requirements for existing/proposed units.

**E-1c(2) Inactive Surface Impoundments**

As part of this Request for Permit modification, CHCI shall assume ownership and operational control of four (4) inactive surface impoundments which were formerly used to manage process water from an onsite hazardous waste incinerator. The impoundments have been closed in-place in accordance with IL EPA closure requirements, and the final closure has been certified IL EPA. The surface impoundments are currently operating under Post-Closure care.

For these surface impoundments, CHCI does not seek a waiver from the groundwater monitoring requirements of 35 IAC 724 Subpart F. However, in lieu of preparing a separate plan, CHCI shall incorporate into this Request for Permit Modification the APPROVED POST-CLOSURE groundwater monitoring plan developed for the units by the former owner of the site, CWM CHEMICAL SERVICES, INC. (CWMCS). THE CWMCS POST-CLOSURE GROUNDWATER MONITORING plan FOR THE SURFACE IMPOUNDMENTS is incorporated in its entirety and begins on the following page. IN RESPONSE TO COMMENTS MADE BY IEPA IN DECEMBER 1995, CHCI PROPOSES THE FOLLOWING MODIFICATIONS TO THE APPROVED POST-CLOSURE GROUNDWATER MONITORING PLAN:

1. SECTION 4.1.3 - CHCI PROPOSES TO DETERMINE THE DEPTH OF THE GROUNDWATER MONITORING WELLS ON AN ANNUAL BASIS.
2. SECTION 4.1.3 - CHCI PROPOSES TO MODIFY THE GROUNDWATER MONITORING PLAN TO INDICATE THAT THE SAMPLES COLLECTED FOR INORGANIC ANALYSIS AND COMPARISON TO THE 35 IAC 620 GROUNDWATER QUALITY STANDARDS WILL BE UNFILTERED.

CHCI SHALL ASSUME FULL RESPONSIBILITY ALL ACTIVITIES DESCRIBED IN THE POST-CLOSURE GROUNDWATER MONITORING PLAN WHERE THE PERMITTEE IS REFERENCED TO AS "CWMCS".

**SECTION E  
GROUNDWATER MONITORING**

**E-1 Exemption from Groundwater Protection Requirements 703.185,  
724.190(b)**

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All proposed hazardous waste management units are designed and will be constructed in compliance with the secondary containment requirements of 35 IAC 724 Subpart I (Use and Management of Containers) and 35 IAC 724 Subpart J (Tank Systems).

~~Because~~ All existing and proposed hazardous waste units at the facility are/will be NON-LAND BASED TANK AND CONTAINER MANAGEMENT UNITS WHICH ARE equipped with secondary containment devices, ~~there is no potential for migration of liquid from a regulated unit to the uppermost aquifer during the active life of the regulated unit and during the post-closure period~~ AND ARE EXEMPT FROM GROUNDWATER MONITORING REQUIREMENTS AND THE "NO LIQUID MIGRATION" DEMONSTRATION REQUIREMENT. As such, CHCI DOES NOT requests a waiver from all 35 IAC 724 Subpart F groundwater monitoring requirements for existing/proposed units.

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CHCI SHALL ASSUME FULL RESPONSIBILITY ALL ACTIVITIES DESCRIBED IN THE POST-CLOSURE GROUNDWATER MONITORING PLAN WHERE THE PERMITTEE IS REFERENCED TO AS "CWMCS".

**Clean Harbors of Chicago, Inc.  
11800 S. Stony Island Avenue  
Chicago, IL 60617**

**EPA ID No. ILD000608471**

**RCRA Part B License  
Request for Permit Modification  
July 15, 1994**

**[Revised February 8, 1995]**

**Volume 5: Section E  
Text/Tables/Figures &  
Appendices E-1 through E-5**

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**Volume 1: Text/Tables/Figures  
Sections A through D**

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**[Revised February 8, 1995]**

**Volume 1: Text/Tables/Figures  
Sections A through D**



## Golder Associates

CONSULTING GEOTECHNICAL AND MINING ENGINEERS

### VOLUME I

GROUND-WATER ASSESSMENT REPORT  
SCA CHICAGO INCINERATOR FACILITY  
CHICAGO, ILLINOIS  
FOR  
SCA CHEMICAL SERVICES, INC.

(VOLUME I - TEXT AND FIGURES)

### Distribution

12 copies - Chemical Waste Management, Inc., Oak Brook, Illinois  
2 copies - Golder Associates, Denver, Colorado  
1 copy - Golder Associates, Atlanta, Georgia

August 1987

873-2096

EXECUTIVE SUMMARY

This report presents the results of the ground-water assessment undertaken at the SCA Chicago Incinerator in Chicago, Illinois. The incinerator is located on the east side of Lake Calumet, in south Chicago, Illinois. RCRA regulated units were constructed on the pier in 1982. The pier, on which the impoundments have been built, consists of miscellaneous debris, concrete, brick, wood, steel, slag and sludges.

The results of an extensive ground-water assessment undertaken in 1985, which included installation of several wells and substantial analytical testing, concluded that the impoundments were not impacting the ground-water quality, and that other sources were impacting the ground water. After completing the assessment in 1986, the first quarterly sampling event following the return of the facility to detection monitoring failed the CAFE Student's 't' test using 35 IAC 725 indicator parameters. The site entered a second ground-water assessment phase in 1986 even though the analytical data were consistent with the assessment evaluation and conclusion.

The purpose of the second assessment was, again, to determine if hazardous waste constituents were migrating from the RCRA regulated units. The assessment was carried out using four stainless steel wells installed for the first assessment at the site. Analytical testing for proposed Appendix IX parameters was carried out. Several techniques including time trend comparisons, chemical fingerprinting, review of historical trends and statistical methods were used to assess the results of the analytical testing.

The results of this (the second) assessment indicate that hazardous waste constituents are not migrating from the surface impoundments which are the RCRA regulated units. The results of the assessment have also clearly indicated that the quality of the ground water is substantially impacted by upgradient conditions and the variable and heterogeneous nature of the fill materials used to originally construct the pier. These results are consistent with the results of the previous assessment. In fact, the ground water quality has improved over time.

Following completion of this assessment, the site should stay in a continuing assessment as defined by 35 IAC 725 with a modified monitoring program until the regulatory status of the impoundment is made subsequent to the imminent closure. The modified monitoring program would utilize a select list of parameters and sampling and analyses would be carried out on a quarterly basis. If pre-determined action levels are exceeded by any of the select list of monitoring parameters, a more comprehensive assessment would be undertaken.

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## 1.0 INTRODUCTION

The SCA Chemical Services, Inc. (SCA) Chicago Incinerator Facility, is located on, and adjacent to, a pier on the south-eastern side of Lake Calumet in southeastern Chicago, Cook County, Illinois. SCA is a subsidiary of Chemical Waste Management, Inc. (CWMI). The approximate location of the site is shown on Figure 1. The facility includes the incinerator process area at the head of Slip 6 and surface impoundments approximately midway out on the pier between Slips 6 and 8. Layout details of the surface impoundments are shown on the attached Figure 2. The pier on which the facilities are constructed was built in the late 1950's, and the fill for the pier consists primarily of concrete rubble, masonry rubble, wood and metal scraps, sludge, slag, cinders and clay. Prior to SCA's leasing of the site for the facility from the Chicago Regional Port District, the pier was used for several waste-related operations including processing of organic materials in so-called "bio-beds". Numerous lagoons constructed for those purposes were subsequently cleaned out and backfilled. The land-fill associated with the clean-up of the "bio-bed" lagoons is located on the existing pier, west of the surface impoundments (Figure 2), in accordance with the Consent Agreement between the State of Illinois and the Port Authority.

In February 1984, the first post-background sampling of the wells yielded data indicating that a statistically significant change in pH had occurred in all wells, and a statistically significant change in specific conductance in Well G-111A had also occurred. As a result of these statistically significant changes, as deter-



mined by the Cochran's approximation to the Behrens-Fisher (CABF) Student's 't' Test, a ground-water assessment was undertaken starting in July 1984. The results of that assessment were summarized in Golder (1986a), and the results of the three investigatory phases were presented in PELA (1985), Hydro-Search (1985) and Golder (1986b). Copies of the summary report, Golder (1986a), and the detailed evaluation of the ground-water geochemistry, PELA (1985), are presented in Appendices I and J respectively. The first assessment included construction of several new wells, in addition to the RCRA monitoring wells. The detailed evaluation of historical geochemistry and sampling and testing for hazardous waste constituents based on gate receipts, concluded that hazardous waste or hazardous waste constituents were not migrating from the RCRA regulated unit. Furthermore, the first assessment also concluded that the quality of ground water at the site was significantly impacted by the heterogenous nature of the fill materials, historical site usage, and upgradient sources of contamination, which include non-regulated units at the facility and off-site sources.

Upon successful completion of the ground-water assessment, the site re-entered the detection monitoring phase of 35 IAC 725 in 1986. Following one quarter of detection monitoring, statistically significant changes in some of the detection monitoring parameters were again computed based on the CABF Student's 't' Test. During a meeting with the Illinois Environmental Protection Agency (IEPA) and the U.S. EPA on October 20, 1986, SCA and CWMI were advised by the agencies that the site must again undertake a ground-water assessment to determine whether or not the surface impoundments were, in fact, impacting the ground-water quality.

Subsequent to that meeting on October 21, 1986, SCA submitted a ground-water assessment plan outlining the proposed methodology which would be followed to conduct the ground-water assessment.

During the period between October 21, 1986 and April 23, 1987, negotiations were conducted with the IEPA to discuss and revise the contents of the ground-water assessment plan (see Appendix A for a description of these activities). During the interim period, discussions were held to establish the constituents that would be analyzed for in the assessment, and it was agreed that the analytical testing would include the proposed Appendix IX parameters, including dioxins and furans. The revisions to the assessment plan were submitted to the IEPA in a letter dated April 29, 1987. Comments from the IEPA expanding on the April 29, 1987 submittal were contained in a letter from the IEPA dated May 21, 1987. Details of the proposed ground-water assessment plan and the comments from the IEPA are also presented in Appendix A.

Results of the ground-water assessment are presented in the following sections of this report. It should be noted that the sampling, testing, and evaluation for the assessment were carried out on the four stainless steel wells -- G-120S, G-121S, G-123S, and G-124S as agreed upon with the IEPA in the assessment plan (Appendix A). Concurrent with sampling for the ground-water assessment under 35 IAC 725, sampling of several additional PVC and stainless steel wells was carried out to satisfy state permit requirements.

Results of the analytical laboratory testing for both the assessment wells and for the other wells have been used in this report to assist in the overall evaluation of the impact on the ground water from the regulated unit.

## 2.0 SUMMARY OF HYDROGEOLOGIC SETTING

### 2.1 Subsurface Soil Conditions

As outlined previously, the pier on which the impoundments have been built was constructed during the late 1950's, and the fill for the pier primarily consists of 7 to 18 feet of cement fragments, masonry rubble, wood and metal scraps, slag, sludge, cinders and clay. The surface impoundments consist of four clay-lined ponds which constitute the regulated units for RCRA groundwater monitoring purposes. The approximate locations of the impoundments are shown on Figure 2. The two eastern ponds, referred to as Pond 1 (northern) and Pond 2 (southern) are used to cool and store process water from the air pollution control system of the hazardous waste incinerator. The southwestern pond, referred to as Pond 3, is a storm water retention pond. Sludge periodically removed from Ponds 1 and 2 is stabilized in the northwestern pond, referred to as Pond 4, prior to its being hauled away to an off-site hazardous waste disposal facility.

The variable and random pier fill materials are underlain by Holocene marsh deposits and lacustrine silty clay deposits of Wisconsin age (Figures 3 and 4). The heterogeneous nature of the fill materials, and the fact that considerable fill materials have been placed below the waterline make the hydrogeologic setting at the site artificial. Because the fill is underlain by a thick continuous sequence of lacustrine silty clay, the fill itself serves as the water-bearing zone. The wells are screened in the fill to provide immediate detection of migration of hazardous wastes or hazardous waste constituents from the regulated units.

## 2.2 Hydraulic Conductivity of Fill

The results of hydraulic conductivity testing in the fill (Golder 1986a) indicate there are significant contrasts in the hydraulic conductivity. The distribution of hydraulic conductivity values suggest that the fill to the north of Ponds 1 and 4 (Figure 2), and to the east of Pond 1, has a hydraulic conductivity 1 to 2 orders of magnitude greater than the fill materials to the south and west. To the north and east of the impoundments, the hydraulic conductivity of the fill materials ranged from  $5 \times 10^{-3}$  to  $1 \times 10^{-5}$  cm/sec, and to the south and west of the impoundments, the measured hydraulic conductivities ranged from  $1 \times 10^{-4}$  to  $8 \times 10^{-6}$  cm/sec in the fill materials.

## 2.3 Hydraulic Gradients and Potentiometric Surface

As described in Golder (1985a), if the pier was comprised of homogeneous materials, it would be expected that the potentiometric surface would approximate a symmetric ridge whose axis would run parallel to the long axis of the pier. While this is fundamentally the case, as a result of the extremely heterogeneous nature of the fill materials that form the pier, the variable surface infiltration resulting from cover and grading variations and past activities at the site, i.e. backfilled "bio-beds", there are some deviations from the general configuration outlined above. Potentiometric maps of the immediate vicinity of the impoundments based on water levels obtained as part of the April 1987 sampling event are shown on Figure 5.

## 2.4 Monitoring Well Network

The existing RCRA (detection) monitoring network consists of up-gradient monitoring Well G-112B and downgradient monitoring Wells G-110, G-111A and G-113A. The approximate locations of the monitoring wells used for RCRA detection monitoring purposes are shown on Figures 2 and 5.

These monitoring wells were installed by Testing Service Corporation in 1982. Details of the subsurface conditions at each location and approximate details of the monitoring well construction are presented in Appendix B.

During the first assessment at the site, an additional six stainless steel monitoring Wells G-120S to G-125S, inclusive, were constructed around the regulated units using state-of-the-art well construction and development techniques to supplement the information obtained from the RCRA detection monitoring wells. Subsurface conditions, construction details and development records for each of the six stainless steel wells are presented in Appendix C. The stainless steel wells have five-foot long screens, effective screened intervals varying from 8 to 11 feet in length, and are all screened in the fill materials.

Of these six stainless steel wells, upgradient Well G-123S and downgradient Wells G-120S, G-121S and G-124S were used in the 1987 ground-water assessment at the facility. These wells were chosen from the six stainless steel wells for this assessment because of their proximity to the RCRA monitoring wells as agreed to with the IEPA. While the stainless steel wells were utilized for the first (1984) assessment and current (1987) assessment, SCA still believes that PVC is an acceptable material for well construction at the site.

As shown on Figures 2 and 5, based on the site hydrogeologic setting, the stainless steel wells utilized in the ground-water assessment are located at positions that would provide the immediate detection of a release from the regulated unit. The down-gradient wells have been constructed between the RCRA wells and the edge of the impoundments. The upgradient well is immediately adjacent to the upgradient RCRA well.

### 3.C SAMPLING PROCEDURES

Sampling of the RCRA monitoring wells and the stainless steel assessment wells for the ground-water assessment was carried out on April 29, 1987 and April 30, 1987. Sampling of the impoundments and sampling for state permit wells was carried out on May 1, 1987. The sampling procedures were in agreement with EPA and Waste Management, Inc. (WMI) corporate protocols as is done from all sampling events. For completeness, the WMI Ground-Water Sampling Manual outlining the appropriate protocols and sampling methods is included in Appendix D. Gulf Coast Laboratories undertook the proposed Appendix IX sampling. A grab sample of the process water was obtained from the discharge pipe coming from the cooling pond. Aliquots from the wells and the impoundments were unfiltered except for dissolved metals. The preservatives used are listed in Table 1. The four stainless steel wells were sampled using stainless steel bailers. The preservatives and filtration techniques used are listed in Table 2. All preservatives are added to the bottles prior to sampling, except for filtered samples where preservatives are added after filtering.

#### 4.0 ANALYTICAL METHODS

The methods used by Environmental Testing and Certification (ETC) for analysis of proposed Appendix IX parameters were based on EPA manual, SW-846, entitled, "Test Methods For Evaluating Solid Wastes" (July 1982). The methods were extended by ETC for those Appendix IX compounds which are not included in SW-846. Standard spectra literature was used where no standard reference materials were available. The actual methods used are summarized in Appendix E.

#### 4.1 SCA Data Review

Results of all of the analytical testing performed by ETC were reviewed internally by SCA upon receipt of each portion of the data. The purpose of this review was to determine if there were any major inconsistencies in the data based on the specific analytical information and historical data trends at the site. Inconsistencies were noted in the results for dissolved and total metals as well as in the chloride results. Based on the internal review, SCA has issued Quality Action Reports (QAR's) requesting that additional sampling/evaluation of specific samples be carried out. Copies of the QAR's are included in Appendix K. Another QAR will be issued to clarify pesticides tentatively identified at trace levels in the impoundments, some of the wells, and the QA/QC blanks. Based on the items identified in the QAR's, it is not anticipated that the resolution of the discrepancies will change the conclusions presented herein. Verbal responses from ETC has been noted on the QAR's. The corrections indicate consistent results with historical data. Therefore, immediate resampling is not considered necessary. As a result of the compact schedule allowed for the ground-water assessment, the QAR formal response and corrected technical reports will not be available until after the deadline for submittal of the ground-water assessment report. This information will be submitted promptly after review.



## 5.0 ANALYSIS AND EVALUATION OF ANALYTICAL DATA

### 5.1 General

The first stage in the evaluation is to verify the integrity of data. The second stage is to interpret data to determine if there are any hazardous wastes or hazardous waste constituents at significant concentrations in the assessment wells. Following this, if hazardous waste or hazardous waste constituents are observed at significant concentrations, a comparison of the assessment wells and impoundment water quality will be made. If it is determined that the hazardous waste constituents in the assessment wells are the result of a release from the regulated units, determination of the rate and extent of migration will be conducted. If it is determined that ground-water contamination was not caused by the regulated units, a monitoring program will be proposed. Additional ground-water investigations will be conducted pursuant to the facilities' Part B permit.

### 5.2 Data Review

The results of the analytical work carried out by ETC on ground-water samples from each of the assessment wells for proposed Appendix IX parameters are presented in Appendix F. Prior to discussing the results in detail, it is useful to discuss the reporting procedures used by ETC and the techniques used to review and evaluate the raw data prior to use in the ground-water assessment plan.

In the ETC reports of analytical data on proposed Appendix IX parameters in Appendix F, if a constituent was not detected in a sample, it is identified as not detected (ND); and if a constituent is potentially detected at less than the Instrument Detection Limit (IDL) in the preliminary report, it is listed as BMDL

or Below the Instrument Detection Limit established by ETC. After QA/QA review, the value is either numerically reported or noted as "ND".

To evaluate the analytical data, there are several steps that were undertaken prior to detailed data analysis to validate the data and to ensure the results obtained were representative. Because of the many factors that can introduce error into analytical results, several steps were taken to determine whether or not the analytical results were valid.

The initial step in the review of the analytical data was a thorough review of the lab and field procedures used. This included a review of machine calibration information, assessment of the arithmetic calculations, a review of the recoveries measured on spiked samples, and a review of all information on blanks tested that day. In addition, a detailed review of the Chain-of-Custody records for the sampling, shipping, and preparation of the samples was carried out. This review work was carried out by SCA and CWMI personnel, and a few questionable results were identified. In response to this review, several QAR's (Appendix K) were prepared and forwarded to ETC for review. As of the time of preparation of this ground-water assessment report, ETC has verbally responded to some of the QAR's; some of the corrections are included in the QAR's. The corrections will not affect the conclusions of this assessment, and therefore no resampling is proposed.

The results of all of the analytical testing for the proposed Appendix IX parameters were provided by ETC and are presented in detail in Appendix F. To facilitate data evaluation, the results of all testing by ETC on the assessment wells and on the RCRA monitoring wells were entered into a project database. A detailed discussion of the results of the evaluation and the comparison of the impoundment water quality data is presented in Section 6.0.

### 5.3 Data Manipulation

The methods used for performing the evaluations for this report were chosen after an initial appraisal of the volume, format and content of the data. The volume of data was sufficient to preclude the evaluation being made by inspection alone, and therefore, a data handling system was used. A review of the content of the data suggested that tabular and graphical representations of the data would aid in the evaluation.

The data was entered into a relational database to enable flexibility in performing selections and sorts of the data. The system used was a customized development of the Revelation Release G2 database. The database produced for this report contained 5285 records. Each record contains, at least, the following fields: a location identifier, the date sampled, a laboratory sample code, the parameter name, concentration, units, the reported method detection limit, and a description (e.g. duplicate). Selection and sorts were performed using limits as required on the entire database or on a subset. Both sorts, selects and mathematical functions were possible by using one or any combinations of fields.

Data was selected and sorted within the database and initial listings were produced. These listings were used to assess which reporting formats would be best suited to aid in the interpretation and final presentation of the data. Tables and graphs were prepared, and the most useful have been included in this report.

#### 5.4 Data Interpretation

Comparisons between the impoundments and the wells were achieved by several different tabular and graphical methods.

Firstly, for the 1987 chemistry data, Table 3 was produced showing values above the IDL. Using this information, different sampling locations could be visually compared with each other to show whether similar patterns of reported values were occurring (See Table 4). The data in Table 4 is presented so that those reported values occurring only in the impoundments, only in the wells, and in both locations were grouped together.

Table 5 was produced comparing the concentrations of inorganic ions detected in the impoundments during 1987 and the four assessment wells. The Table 5 notes those ions detected in the impoundments at higher, lower or equal concentrations than in the wells.

Table 6 summarizes the organic compounds exceeding the IDL for the 1987 assessment sampling event. Graphical comparisons were achieved by the use of "fingerprints" (Figures 6-1 to 6-22). For each ion analyzed at a certain time, the concentration was plotted on a bar chart. Each bar chart showed all locations so that a visual comparison of concentrations between sampling points could be seen. Variations in concentration of individual parameters with time have been demonstrated by the use of time-trend plots as described later in this report.

In addition to utilizing the time-trend plots and fingerprints to assist in the assessment, Practical Method Detection Limits (PMDL) and Prediction Intervals (PI) were established using published or site specific information where appropriate. A detailed discussion on the exact methods used to establish PMDL's for the SCA Chicago Incinerator is presented in Appendix G. A complete deriva-

tion of the site-specific Prediction Intervals is given in Appendix H. PMDL's are an effective screening tool for data which are reported infrequently. PI's are an effective screening tool where sufficient site-specific information exists.

## 6.0 DATA COMPARISON

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AP 87*

### 6.1 Data Description

As outlined previously, sampling for the ground-water assessment was carried out on April 29, 1987 and April 30, 1987, and sampling for other permit purposes was performed on May 1, 1987. Wells sampled during these periods included RCRA detection monitoring Wells G-112B (upgradient), G-110, G-111A and G-113A (all of which were PVC wells), Wells G-104, G-122S and G-125S and stainless steel assessment Wells G-123S (upgradient) G-121S, G-120S and G-124S and the impoundments. The samples from the non-assessment wells were analyzed for the four indicator parameters and select cations and anions. The samples from the four stainless steel assessment wells and the impoundments were analyzed for the proposed Appendix IX parameters as agreed upon in the ground-water assessment plan. Site historical data and information were also evaluated in preparing this assessment.

As required by the regulatory authorities, when results were available for both total and dissolved metals, the total metals results have been used for interpretation and representation in tables and graphs.

The 1987 analytical chemistry results for inorganic chemistry and for the 1985 impoundment sample are summarized in Table 3 following the text of this report. Due to the large suite of chemicals analyzed, only those parameters reported are included in Table 3. Results that are below the PMDL are marked with an asterisk. The analytical chemistry results for organic compounds for the April 1987 sampling event are summarized in Table 4. Also indicated in this table are the PMDL values for the individual constituents (see Appendix G). All 1987 chemistry data on the assessment wells are included in Appendix F.

Data from previous sampling events were used to examine the change in chemistry of the ground water at the site with time. Some of the historic data are presented in Appendix I to this report.

## 6.2 Inorganic Constituents

Several inorganic hazardous waste constituents were detected in both the impoundments and ground-water samples, along with the common parameters present in all ground water. Tabular and graphical comparisons of inorganic constituents in the impoundments and wells are discussed in the following paragraphs to determine if the constituents in the impoundments and ground water exhibit similar characteristics.

### 6.2.1 Tabular Comparison

Tables 4 and 5 have been produced to illustrate similarities and differences between the water in the impoundments and in the assessment wells. The tables have been compiled by using the data obtained in the April/May 1987 sampling event. Table 4 shows the distribution of reported inorganic parameters between the impoundment and the assessment wells. Table 5 has primarily been used to expand on the interpretations based on Table 4. Table 5 illustrates the relative concentrations of inorganic parameters, and pH and Specific Conductance in the impoundments and the assessment wells. From Table 4, it can be seen that a large number of parameters are reported in the impoundments and in at least one monitoring well. A review of these parameters using Table 5 was made to assess what conclusions could be based on the relative values for each parameter between the impoundments and assessment wells.

Table 4 shows that 17 inorganic parameters were reported in the impoundment. Sixteen inorganic parameters were reported in the stainless steel assessment wells. Of the 17 inorganic parameters reported, 10 were also in G-120S; 9 in G-121S; 10 in G-123S; and 9 in G-124S. Three parameters were reported in the assessment wells, but not in the impoundments; and four parameters were not found in the assessment wells, but were in the impoundment, indicating dissimilar patterns. The cations found only in the impoundment sample were Cadmium, Copper, Mercury and Selenium. These cations, especially Cadmium and Mercury, are not normal constituents of ground water, and the absence of these cations from the ground water is expected. The three ions found only in the assessment wells, Beryllium, Cyanide and Nickel are also not usual constituents of ground water. The presence of these ions, particularly Cyanide in the assessment wells, but not in the impoundments, indicate that poor quality ground water exists near the impoundments, and a source other than the impoundments is responsible.

Of the 20 parameters listed in Table 4, the largest subset are those which were reported in the impoundments and in at least one assessment monitoring well. This subset contains 13 ions, the majority of which are common ground water constituents. There are only three ions -- Arsenic, Chromium and Lead -- which are unusual constituents in ground water in many areas; and three ions -- Aluminum, Fluoride and Zinc -- which are occasionally found in natural ground water. Arsenic and Chromium were only found in one well and Lead was found in three wells. The review of the largest subset shows that although many parameters were found in both the impoundments and at least one monitoring well, the only parameters which would not normally be expected to be present in both were few and not present in all wells. The further observation that the unusual ions which are present both in the impoundments and assessment wells, but which are not present in all the assessment



wells, suggests that their presence in both the wells and impoundment is coincidental. The review of data as presented in Table 4 has shown that there is no substantive link between the waters in the impoundments and assessment wells which could be construed as being caused by a release from the regulated unit.

Table 5 shows a comparison between the impoundments and the assessment wells for the April 1987 sampling. Only parameters which were reported in the impoundments have been included. For each parameter, and for each of the wells analyzed for proposed Appendix IX parameters, the table shows whether the parameter was recorded at a greater or lesser concentration when compared with the impoundments. As discussed in Section 6.3, due to the lack of organic parameters in the impoundments, only inorganic parameters are possible indicators of leakage into the ground water from the impoundments. There are five ions which were reported at a higher concentration in the impoundments than any of the assessment wells in the April 1987 sampling; these were Aluminum, Arsenic, Fluoride, Lead and Zinc. Also, pH was reported higher in the impoundments than any of the four assessment wells. There were four ions which were present in all wells at a higher concentration than the impoundments; these were Calcium, Magnesium, Manganese and Potassium. There were three ions for which the concentration in the impoundments was greater in one or more wells, and less in one or more wells; these compounds were Barium, Iron and Sodium. Specific Conductance was also less than the impoundments in three wells and greater than the impoundments in one well. All three subsets of this comparison contain ions which could be expected to be mobile at this site. The most mobile ions are expected to be Arsenic, Zinc, Fluoride, Potassium and Sodium. The five ions which were reported at higher concentrations in the impoundments than the ground water in the surrounding wells were at concentrations not commonly associated with natural ground waters. The ions which were present in some or all wells at higher concentra-

tions than the impoundments are common constituents of ground water. The comparison between the four assessment wells does not show a strong correlation between one well and any other.

The presence of ions in the impoundment which are mobile and at a higher concentration than in any of the wells, in conjunction with mobile ions being present in wells at higher concentrations than in the impoundment, is evidence that the impoundments are not affecting the ground water.

The discussion of Tables 4 and 5 have shown that these are ions not normally associated with natural ground waters at the site. The distribution and relative concentrations of these ions between the impoundment and the stainless steel assessment wells, and also between these wells, is random. Certain ions which are not normally associated with ground waters, and are therefore, possible indicators of contamination, are found exclusively in the impoundments, with others found exclusively in the wells and still others found in both the impoundments and wells. The above discussion supports the conclusion that the impoundments are not adversely affecting ground water and that there is a source other than the impoundments for the parameters found in the ground water.

#### 6.2.2 Graphic Comparisons

Fingerprints were produced for several inorganic parameters showing the relationship between reported concentrations and locations where analyzed at a certain time. These fingerprints are presented as Figures 6-1 to 6-22. If a parameter was analyzed, and detected below its PMDL (or the IDL, if no PMDL was available), it is indicated on the fingerprint graphs as an asterisk (\*). Therefore, where they occur, blank positions indicate that the parameter was not analyzed for at that particular location and time. Discussions on the evaluation of the graphic presentations are as follows:

Sodium (Figure 6-18 to 6-21) and Chloride (Figure 6-5 to 6-7)

Throughout 1985, both the impoundments and Well G-112B showed higher concentrations of Sodium and Chloride compared with the other wells. Sodium and Chloride concentrations in the impoundments increased from February to May 1985. This increase has not been reflected in the concentrations in the other wells except at Well G-112B. The increase at Well G-112B was demonstrated to be due to past pipeline breaks, and not due to leakage from the impoundments. The levels have decreased significantly since the first assessment. The increases noticed in the impoundments are due to the variations in feed stock entering the incinerator and changes in water treatment chemicals used at the incinerator which are reflected in varying concentrations of Sodium and Chloride being pumped to the impoundments. The fingerprint for Sodium in the 1987 sampling shows that the highest concentration was in G-121S. The concentrations in Wells G-120S, G-123S and G-124S (the other three assessment wells) are substantially lower than the concentration in the impoundments. The Sodium concentrations in the impoundments do not appear to have impacted the assessment wells. The high concentration in Well G-121S, which is greater than the impoundment concentrations, is probably due to an artifact of fill construction, and is not considered to be migration from the impoundments. Historically, data from well G-121S are extremely inconsistent and variable, reflecting the nature of the fill. For example, Sodium and Conductivity data do not follow the same pattern (see Figures 9-50 and 9-73).

Barium (Figure 6-4)

The highest concentration of Barium during the April 1987 sampling was in Well G-120S. This was greater than twice the concentration reported in the impoundments, although present at low levels. The distribution of Barium does not follow the pattern as shown with any other ions. The higher concentration in Well G-120S compared to the concentration in the impoundments shows that this could not be due to migration from the impoundments. When Barium concentrations in the impoundments and wells were compared, two wells had similar concentrations; one well had a higher concentration, and one well had a lower concentration.

Potassium (Figure 6-15 to 6-17) and Manganese (Figure 6-11 to 6-14)

Potassium and Manganese are being considered together because the concentrations in the impoundments for both cations are substantially less than those reported in the wells. The concentrations of Manganese in the impoundments are, in general, an order of magnitude less than the concentrations in the wells. The distribution of Manganese in the wells is dissimilar to that of Potassium, Barium or the other ions. It is, therefore, apparent that the Manganese and Potassium in the ground water did not originate from the impoundments.

Aluminum (Figure 6-1), Fluoride (Figure 6-8), Lead (Figure 6-9 and 6-10) and Zinc (Figure 6-22)

The cations Aluminum, Lead and Zinc, and the anion Fluoride are present in substantially higher concentrations in the impoundments compared with the wells, which leads to the conclusion that the impoundments are not the source of these ions.

Arsenic (Figure 6-2 and 6-3)

The fingerprint of Arsenic from the 1985 data shows that the concentration in the impoundments is less than the concentrations in Wells 120-P and G-111. In 1987, however, the concentration in the impoundments was four times the concentration reported in 1985, and it was also greater than the concentrations reported in the four assessment wells. The concentration of Arsenic in Wells G-121S, G-123S and G-124S is not significant. The high concentration in Well G-120S is almost certainly due to an artifact of the construction of the fill. Arsenic in low concentrations occurs in natural clayey soils in the region and some clay fill materials were used in the construction of the pier. The fill also contains slags that often contain substantial concentrations of Arsenic.

The review and summary of current and historic fingerprints discussed above lead to the conclusion that inorganic constituents are not migrating into the ground water from the regulated units.

### 6.3 Organic Constituents

The proposed Appendix IX organic compounds reported in the April 30, 1987 samples from the assessment wells are summarized in Table 6. As noted from Table 6, no organics were detected at significant levels in the impoundments or Well G-124S during the 1987 sampling. Further, the isolated organic compounds reported in Wells G-120S and G-123S are not significant.

Organic compounds were not detected at significant levels at any locations apart from Well G-121S during the April 1987 sampling program indicating the extremely heterogeneous nature of the fill. Review of the borehole log for Well G-121S indicates that the effective screened interval for the monitoring well extends across two layers of what was described by an experienced geotechnical engineer as "black, oily sludge." Based on the borehole log for the monitoring well, the organic compounds observed would be expected to originate from the fill and represent the background quality of the ground water in the area of the well.

Previous data from the facility also indicate the presence of organic compounds at levels of concern in other areas (including positions upgradient from the impoundments). The distribution of organic compounds, historically at significant levels in the immediate vicinity of the impoundments, is shown on Figure 7. The organics present in the ground water originate from the composition of the fill, the historical use of the site, or have originated from the surrounding areas which are known to be contaminated. There is no evidence to suggest that the organic compounds in the ground water have come from the regulated units. In fact, no organic compounds have been present at significant levels in the impoundments during any sampling event.

The incineration process results in destruction of virtually all organic constituents, so it is extremely unlikely that significant concentrations of organic constituents have ever appeared in the surface impoundments. The corrective action provisions of SCA's RCRA permit will require a thorough analyses of the former solid waste management units at the facility which may be the source of the inorganic constituents. Therefore, SCA will not address these units in detail in this assessment report.

#### 6.4 Well G-114 Comparison Scatter Plots

To obtain a comparison of off-site background ground-water quality with the wells adjacent to the impoundments and the impoundments themselves, 1985 data for well G-114 has been used. Comparisons for available parameters of background Well G-114 (adjacent to the northeast corner of the property and located at a significant distance from current and former waste management activities at the site, Figure 2) with other wells and the impoundments analyzed during 1985 are presented on Figures 8-1 to 8-10 inclusive. The values which have been graphed are the arithmetic average if more than one value is available for 1985. The values reported for the impoundments include an arithmetic average calculated on the data reported as North, South, East, West and IMPDE. The data which have been graphed include inorganic parameters and the indicator parameters TOC, TOX and Specific Conductivity.

To enable Specific Conductivity to be used in these comparisons, Specific Conductivity has been estimated on the basis of the available Sodium and Chloride results when the measured Specific Conductivity was found to be greater than 20,000 umhos/cm. The method used to estimate the Specific Conductivity was to match the calculated anhydrous solute concentration of Sodium Chloride with values of Specific Conductivity found in the conversion table,

"Concentrative Properties of Aqueous Solutions", Handbook of Chemistry and Physics. These calculated Specific Conductivities are shown in Table 7.

#### 6.4.1 TOC and TOX (Figure 8-8 and 8-9)

Discussion of the organic chemistry using the G-114 comparison plots is limited to evaluation of TOC and TOX, since no other data are available.

The highest TOC reading was approximately 100 mg/l recorded in Well G-120S. The reported TOC concentrations are considered to be an artifact of the fill or past site practices. TOC analyses from the impoundments were reported as an average of approximately 30 mg/l. The only conclusion which can be reached from consideration of TOC results is that the impoundments are not the source of the high TOC readings which are being reported in many of the wells surrounding the impoundments.

TOX has been developed as a test for the estimation of the concentration of total organic halides in the sample. The TOX readings are considered to be an unreliable parameter at both this site and elsewhere, especially when associated with high Chloride concentrations. Historically, the laboratory has had difficulty with TOX due to Chloride interferences at this site. The TOX is not considered a useful parameter at this site and should not be considered in this or subsequent evaluations.

It must be reiterated that, as no organic compounds have been detected in the 1987 impoundment samples, the large suite of organic compounds reported outside the impoundments could not have come from any leakage from the impoundments.



#### 6.4.2 Specific Conductivity (Figure 8-10)

The Specific Conductivity values mimic the concentrations of Chloride. The value at Well G-114 is slightly above that at Well G-120S, which is the lowest reported value. As discussed in Section 6.5.1, Specific Conductivity data are of very limited value when considering whether hazardous wastes or hazardous waste constituents have migrated from the regulated units.

#### 6.4.3 Chloride and Sulfate (Figure 8-2 and 8-7)

The two anions graphically shown in the G-114 comparison are Chloride and Sulfate. The concentration of Sulfate at Well G-114 is similar to that of the highest concentrations found in the assessment wells. The high degree of variability of the Sulfate values in the ground water is further evidence that the regulated units are not affecting ground water.

#### 6.4.4 Cations (Figures 8-1, 8-3, 8-4 and 8-5)

The cations used in the Well G-114 comparison scatter plots are Calcium, Iron, Manganese and Potassium. The concentration of these cations in the impoundments cannot be correlated with the concentrations in the wells. Calcium, Manganese and Potassium are present in the impoundments at levels which are noticeably below that of the G-114 background well. The concentrations of Iron and Manganese are substantially lower in some wells adjacent to the impoundments than in the upgradient background Well G-114.

Potassium is a small soluble univalent cation which would, therefore, be expected to be mobile and it has been detected at the lowest concentration in the impoundments, the highest concentration in the wells adjacent to the impoundments, and at a concentration only slightly higher than the impoundments in the upgradient

background Well G-114. The above, in particular the low concentrations of Potassium in the impoundment relative to adjacent wells, strongly suggests that the high concentrations in Wells G-111, G-112 and G-113A have been derived from a source downgradient of Well G-114, but that this source is not the impoundments. Consideration of these four scatter plots further suggests that a random distribution of concentrations is present and that the impoundments are not adversely impacting ground water.

#### 6.5 Time Trends

Time trend plots were constructed to assess the overall change of parameters with time. The locations sampled during 1987 have been used as the basis for time trend plots. These graphs show the ground water quality is generally improving with time, and that ground water in the vicinity of the old buried process water pipeline has substantially recovered from the pipeline breaks. The graphs produced are included in Figures 9-1 to 9-90. Small peaks and troughs could be attributed to rainfall and other climatic conditions occurring at the site.

##### 6.5.1 Sodium, Chloride and Specific Conductivity

Wells G-112B and G-113A demonstrate a good correlation between Sodium, Chloride and Specific Conductivity such that the peaks and troughs for each parameter occur at the same time. These two wells also demonstrate a trend of increase in all three parameters from 1982 to 1985 at the time of the pipeline break discussed in the previous assessment, followed by a return to the 1982 levels by 1987. This is a good indication that this area has returned to prior conditions and is not now impacted by the pipeline breaks or from the impoundments. Well G-123S, which is also situated near to the area of the pipeline break, shows a higher concentration of Sodium and Specific Conductivity during 1985 and then later re-

duces. The effect of the pipeline break is not apparent in Wells G-110 and G-120S, as would be expected, due to their position on the opposite side of the impoundment to the pipeline breaks. The Specific Conductivity of Well G-121S was, on most occasions, shown to be very high (greater than 20,000 umho/cm). Sodium and Chloride concentrations also were higher than other wells surrounding the impoundments. This could be due to the impact of the fill material, which has already been shown to contain a heterogeneous range of components.

From November 1986 to January 1987, the Specific Conductivity, however, reduced slightly while Well G-120S showed a fairly constant Chloride, Sodium and Specific Conductivity. If there was any migration from the impoundments, it would be expected that there would be some significant change at this well for these parameters. Wells G-110 and G-111A show a correlation between Sodium, Chloride and Specific Conductivity. The trends in Well G-110 are all reducing with time, with the exception of the most recent Chloride concentration. This Chloride concentration does not correlate with the Specific Conductivity or Sodium concentrations, and is, therefore, considered to be erroneous. The reducing trend for Well G-110 has continued throughout operation of the impoundments and it has not been noticeably affected by the pipeline breaks.

The trend in G-111A is an increase of these parameters from 1982 with a possible stabilization being shown in recent sampling. The most recent Chloride concentration does not correlate with the Specific Conductivity or Sodium concentrations and is considered to be erroneous. A QAR has been requested to clarify these data.

Some variability of these parameters in the impoundment water due to the influence of the incinerator is normal.

#### 6.5.2 Manganese

Manganese concentrations have generally reduced with time. The wells for which Manganese has been analyzed between 1982 and April 1987 are Wells G-110, G-111A, G-112B and G-113A. These wells show an extremely rapid reduction of Manganese from 1982 to 1983 followed by a leveling off of the time trend plot at the low level. From consideration of Wells G-110, G-111A, G-112B and G-113A, no impact of Manganese concentrations has been apparent from operation of the impoundments.

#### 6.5.3 Sulfate

Data are available to produce a time trend plot for Sulfate from April 1982 to April 1987 for Wells G-110, G-111A, G-112B and G-113A. These data show a generally reducing trend, but there appears to be a random scatter. Upgradient and background well data (G-114, G-112B) indicate similar variances of 1,000 mg/l to 100 mg/l. Data for Wells G-120S, G-121S, G-122S, G-123S, G-124S and G-125S has been collected starting in 1985. The Sulfate concentrations in Wells G-121S and G-122S are slowly decreasing. A random distribution is shown in Wells G-123S and G-120S, and a gradual increase is evident in Wells G-124S and G-125S. No effect on the time trend plots can be ascribed to any obvious external influence.

#### 6.5.4 Iron

Iron has decreased substantially from 1982 to the present in Wells G-110, G-111A and G-113A, which are the only wells for which data are available throughout the period 1982 to 1987. The time trend plot follows a similar distribution to that of Manganese at these wells. Well G-112B shows a similar trend but this is based on a less extensive data set. The time trend plots for Wells G-122S,

G-123S, G-124S and G-125S show a random distribution. The trends in the wells for which data are available from 1982 to 1987 show that the impoundments and pipeline breaks have not adversely affected iron concentrations. Furthermore, the concentration of iron in the ground water is not significant.

#### 6.5.5 pH

The pH time plots for most of the wells are consistent from one sampling time to the next, except for Well G-112B where the pH ranged from approximately 8 to 10. The pH is not a useful parameter for use in this assessment.

## 7.0 DETERMINATION OF RATE AND EXTENT

As discussed in the previous section, there is no evidence to indicate that the ground-water quality is being impacted by the impoundments. In fact, it can be readily seen that the upgradient monitoring well water quality and the down-gradient monitoring well water quality have been severely impacted by sources other than the impoundments. In particular, Well G-121S, which encountered a significant number of hazardous waste constituents, is undoubtedly being impacted by the "black oily sludge" layers encountered in the fill.

There is some evidence of residual effects of the pipeline break still impacting the ground-water quality, but, as shown on Figures 10 and 11, the zone of higher electrical conductivity has reduced substantially in extent between 1985 and 1987, and the impacts of the pipeline break are diminishing. Further evidence of the efforts made during construction to limit the impact of the pipeline break are demonstrated on Figure 9-11, the time trend plot for Chloride at Well G-112B. The pipeline break in the fall of 1985 can be readily identified on this figure. During rehabilitation of the pipeline, the area around the break was excavated and extensive dewatering was carried out with a submersible pump to limit the extent of the impact of the pipeline break. The water produced during the dewatering operation was pumped to the impoundments. The effectiveness of the dewatering operation on the impact of the pipeline break is clearly identified by a significant reduction in Chloride levels in the vicinity of Well G-112B following the break. The extent of contamination and rate of ground-water migration in the vicinity of the pipeline break are outlined in Golder (1986a).

Since there is no evidence to suggest that the impoundments are impacting the ground water, it is neither feasible nor necessary to make a determination of the rate and extent of migration of hazardous wastes or hazardous waste constituents from the regulated units.

SCA addresses its proposed approach to continuation of its ground-water monitoring program for the regulated units in Section 10. In the event that SCA determines that migration of hazardous waste or hazardous waste constituents has occurred from the regulated units in the course of its monitoring program, SCA will determine rate and extent of migration in accordance with Appendix L.

## 8.0 CONCLUSIONS

The results of this assessment indicate that hazardous waste constituents from the impoundments are not impacting the ground water. The results of this assessment have also clearly indicated that the quality of the ground water is substantially impacted by upgradient conditions, historical site usage, and the variable and heterogeneous nature of the fill materials used to originally construct the pier. The zone of contamination associated with the pipeline break is substantially reduced when compared to the results of the previous assessment at the site (Golder 1986a).

Closure plans have been submitted for the impoundments and are currently under review IEPA. As currently planned, SCA will begin closure of the impoundments following notification that the proposed closure plans are approved by the appropriate agencies. The nature and extent of the contamination of the ground water at the facility will be thoroughly addressed in the Corrective Action requirements of the Part B Permit for the facility which is currently under review by the agencies.

SCA did not make a determination of the rate and extent of migration of hazardous waste and hazardous waste constituents from the regulated units due to its conclusion that the constituents which are present in the ground water are not attributable to migration from the regulated units. This approach is consistent with the EPA's Technical Enforcement Guidance Document.



9.0 SCHEDULE

In a letter dated May 21, 1987, the IEPA provided a schedule that the ground-water assessment for the SCA Chicago Incinerator was to follow. With submission of this ground-water assessment report, the schedule provided by the IEPA has been met.

An outline of the schedule provided by the IEPA and the actual activities accomplished within the schedule time frame is as follows:

Agency Date	Activity	Actual Date	Comments
4/24/87	Mobilization	4/15/87 to 4/28/87	Mobilization.
6/23/87	Sampling	4/29/87 to 5/1/87	Sampling and analysis <u>only</u> ; schedule does
	Analysis (resampling if re- quired)	4/29/87 to 7/23/87	not permit resampling and analysis.
	Internal SCA QA/QC	7/15/87 to Date	Not scheduled in original timetable.
7/23/87	Review and Evaluate Data	7/22/87 to 8/10/87	Data evaluated based on availability from ETC.
8/12/87	Prepare and Submit Final Report	7/15/87 to 8/12/87	Done in tandem with evaluation of data.

It should be noted, however, that review of the analytical data from ETC identified a few results that required verification of the protocols, procedures and data. At the time of this submission, only a verbal response to the QAR's prepared by SCA has been received from ETC. While clarification of the data is not expected to yield information that will substantially alter the

conclusions presented herein, this point is brought forth to advise the agencies that final review and clarification of a minor portion of the data will be completed and submitted shortly. Preliminary verbal response to the QAR's indicates that resampling is not required as no significant impacts of the conclusion of this report would result.

In the letter of May 21, 1987, the IEPA outlined five specific points that were to be addressed in the ground-water assessment. These points and the areas in the assessment report in which they are addressed are outlined below. The reader is referred to Appendix A for a complete description of the points raised.

Point No.	Description	Section of Text
1	Sampling techniques	3.0 and Appendix D
2	Dioxins and Furans	Appendix F
3	Evaluation procedures	5.0 and 6.0
4	Size of regulated unit	2.1
5	Rate and extent determination	7.0

## 10.0 RECOMMENDATIONS

Since the ground-water assessment for the impoundments has determined that the impoundments are not impacting the ground-water quality at the site, there is no regulatory requirement to carry out rate and extent determinations or to prepare corrective action plans to remediate the site, and the assessment is complete.

If the site returns to detection monitoring as defined by 35 IAC 725.193 using the four indicator parameters and the Cochran's Approximation to the Behren-Fisher Student's 't' Test, based on the variability of the ground-water quality at the site, false positive determinations will result.

SCA has historically presented along with the CABF Students 't' Test, results of the Average Replicate (AR) 't' Test to assess the results of detection monitoring. While not ideal for ground-water monitoring purposes, the AR Test introduces significantly less statistical bias into the evaluation than does the CABF 't' Test and has been recommended by the U.S. EPA in the Technical Enforcement Guidance Document. However, due to the background water quality, the normal techniques are not appropriate for this site.

Upon completion of the previous ground-water assessment, the SCA Chicago Incinerator re-entered the detection monitoring phase required by 35 IAC 725 using the four indicator parameters. At that time, it was necessary to return to detection monitoring as defined by 35 IAC 725 to meet the requirements of the U.S. EPA off-site policy for CERCLA wastes. It is understood from discussions with the U.S. EPA that a site may now (1987) stay in assessment using a modified monitoring system and remain eligible to receive CERCLA wastes. Rather than return to detection monitoring as defined by 35 IAC 725, it is recommended that the facility stay in assessment, and that monitoring of the facility using a site

specific list of hazardous wastes or hazardous waste constituents as monitoring parameters be conducted. Organic constituents are not appropriate indicators because they do not appear in significant quantities in the regulated unit, having been destroyed in the incineration process. A review of historical data has shown that the indicator parameters TOC, TOX, Specific Conductivity and pH which are used as indicator parameters under 35 IAC 725 are inappropriate at this facility. This is due to the heterogeneous nature of the fill on which the site is situated, the historic use of the site and possibly variations in water quality caused by the proximity to the lake. The monitoring parameters at this site should be inorganic ions.

Under a modified monitoring phase, the stainless steel assessment wells and the impoundments would be sampled on a quarterly basis and analyzed for the following constituents:

- Fluoride
- Sodium
- Chloride
- Iron
- Aluminum
- Arsenic
- Lead
- Zinc
- Barium
- VOC's (impoundments only)

The analytical results obtained should be compared to the action levels established for the site. If the constituents exceed the action levels in the assessment wells after confirmation, then an in-depth analysis using Appendix IX parameters should be performed to determine if there has been a release from the regulated unit. If a release from the regulated unit is determined to have

occurred, rate and extent determinations will then be made. As described in Appendix G, the PMDL's and PI's will be reviewed annually to make any necessary adjustments.

The site should continue in this modified phase until the regulatory status of the impoundments after closure is established by the agencies.

SCA believes that its recommended approach, by substantially reducing the false positives that would result from a return to an indicator/evaluation program, provides, in an expeditious manner, a technically justified means of determining whether a hazardous waste or hazardous waste constituents have migrated from the regulated units. If SCA returns to detection monitoring, its first sampling event will not occur for six months, and, if a false positive occurs, an assessment will not commence for an additional month or more and will not be completed for several months. Under the proposed approach, quarterly sampling and data evaluation will continue.

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## 11.0 REFERENCES

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Golder Associates, Inc. (1986a). "Results of Hydrogeologic Investigation, SCA Chicago Incinerator Facility, SCA Chemical Services, Inc., Chicago, Illinois." March 1986.

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TABLE 1

PRESERVATIVES AND FILTRATION TECHNIQUES - IMPOUNDMENT SAMPLES  
SCA CHICAGO INCINERATOR GROUND-WATER ASSESSMENT

---

<u>Analysis</u>	<u>Filtered</u>	<u>Preservative</u>
Cyanide	N	6N NaOH
Sulfide	N	Zinc Acetate
Metals (tot)	N	HNO3
Total Coliform	N	Cool 4 deg C
Extractable	N	Cool 4 deg C
Purge and trap VOA	N	Cool 4 deg C
Heated P&T VOA	N	Cool 4 deg C
Chromium VI, Fluoride	N	Cool 4 deg C

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TABLE 2

PRESERVATIVES AND FILTRATION TECHNIQUES - STAINLESS STEEL WELLS  
SCA CHICAGO INCINERATOR GROUND-WATER ASSESSMENT

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<u>Analysis</u>	<u>Filtered</u>	<u>Preservative</u>
Cyanide	Y	6N NaOH
Sulfide	Y	Zinc Acetate
Metals (tot)	N	HNO3
Metals (diss)	Y	HNO3
Total Coliform	N	Cool 4 deg C
Extractable	N	Cool 4 deg C
Purge and Trap VOA	N	Cool 4 deg C
Heated Pxt VOA	N	Cool 4 deg C
Chromium VI, Fluoride	N	Cool 4 deg C

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TABLE 3 SHEET 1A  
RESULTS OF THE 1987 INORGANIC ANALYSIS  
WELL AND IMPOUNDMENT DATA  
SCA CHICAGO INCINERATOR GROUND-WATER ASSESMENT

SAMPLE POINT DATE	G-104 870128	G-104 870429	G-110 870128	G-110 870429	G-111A 870128	G-111A 870429	G-112B 870128	G-112B 870429	G-113A 870128	G-113A 870429	G-120S 870128	G-120S 870429/ 870430
ALUMINUM (ug/L)	1	***	***	***	***	***	***	***	***	***	***	<30
ALUMINUM, TOTAL (ug/L)	1	***	***	***	***	***	***	***	***	***	***	192*
ANTIMONY (ug/L)	1	***	***	***	***	***	***	***	***	***	***	<500
ANTIMONY, TOTAL (ug/L)	1	***	***	***	***	***	***	***	***	***	***	<500
ARSENIC (ug/L)	1	***	***	***	***	***	***	***	***	***	***	58*
ARSENIC, TOTAL (ug/L)	1	***	***	***	***	***	***	***	***	***	***	120*
BARIUM (ug/L)	1	<30	71*	***	***	***	***	***	***	***	***	781
BARIUM, TOTAL (ug/L)	1	***	***	***	***	***	***	***	***	***	***	751
BERYLLIUM (ug/L)	1	***	***	***	***	***	***	***	***	***	***	<1
BERYLLIUM, TOTAL (ug/L)	1	***	***	***	***	***	***	***	***	***	***	<1.0
CADMIUM (ug/L)	1	***	***	***	***	***	***	***	***	***	***	<3
CADMIUM, TOTAL (ug/L)	1	***	***	***	***	***	***	***	***	***	***	<3.0
CALCIUM (ug/L)	1	***	***	***	***	***	***	***	***	***	***	110000
CALCIUM, TOTAL (ug/L)	1	***	***	***	***	***	***	***	***	***	***	86800
CHLORIDE (mg/L)	1	***	***	190	3800	10000	1100	1400	1100	2300	1065	240
CHROMIUM (ug/L)	1	***	***	***	***	***	***	***	***	***	***	<20
CHROMIUM, TOTAL (ug/L)	1	***	***	***	***	***	***	***	***	***	***	<20
CHROMIUM HEXAVALENT (ug/L)	1	***	***	***	***	***	***	***	***	***	***	<20
COBALT (ug/L)	1	***	***	***	***	***	***	***	***	***	***	<20
COBALT, TOTAL (ug/L)	1	***	***	***	***	***	***	***	***	***	***	<20
COPPER (ug/L)	1	***	***	***	***	***	***	***	***	***	***	<20
COPPER, TOTAL (ug/L)	1	***	***	***	***	***	***	***	***	***	***	<20
CYANIDE, TOTAL (mg/L)	1	***	***	***	***	***	***	***	***	***	***	<.020
FLUORIDE (mg/L)	1	***	***	***	***	***	***	***	***	***	***	0.440*
IRON (ug/L)	1	***	***	<30	<30	<30	90*	***	***	***	875	13900
IRON TOTAL (ug/L)	1	***	***	***	***	***	***	***	***	***	***	15450
LEAD (ug/L)	1	***	***	***	***	***	***	***	***	***	***	<4
LEAD, TOTAL (ug/L)	1	***	***	***	***	***	***	***	***	***	***	<10
MAGNESIUM (ug/L)	1	***	***	***	***	***	***	***	***	***	***	253000
MAGNESIUM, TOTAL (ug/L)	1	***	***	***	***	***	***	***	***	***	***	23200

< = Parameter less than the ETC IDL

\* = Concentration reported below the PMDL

\*\*\* = Parameter not tested for/no available data

TABLE 3 SHEET 18  
RESULTS OF THE 1987 INORGANIC ANALYSIS  
WELL AND IMPOUNDMENT DATA  
SCA CHICAGO INCINERATOR GROUND-WATER ASSESSMENT

SAMPLE POINT DATE	G-104 870128	G-104 870429	G-110 870128	G-110 870429	G-111A 870128	G-111A 870429	G-112B 870128	G-112B 870429	G-113A 870128	G-113A 870429	G-120S 870128	G-120S 870429/ 870430
MANGANESE (ug/L)	***	***	<10	<10	167	16.0*	12*	16.0	40	114	386	338
MANGANESE, TOTAL (ug/L)	***	***	***	***	***	***	***	***	***	***	***	394
MERCURY (ug/L)	***	***	***	***	***	***	***	***	***	***	***	<0.5
MERCURY, TOTAL (ug/L)	***	***	***	***	***	***	***	***	***	***	***	<0.50
NICKEL (ug/L)	***	***	***	***	***	***	***	***	***	***	***	<20
NICKEL, TOTAL (ug/L)	***	***	***	***	***	***	***	***	***	***	***	<20
OSMIUM, (mg/L)	***	***	***	***	***	***	***	***	***	***	***	***
OSMIUM, TOTAL (mg/L)	***	***	***	***	***	***	***	***	***	***	***	***
pH, FIELD	***	***	11.33	11.11	7.93	7.87	9.50	9.37	7.74	7.10	6.99	7.37
POTASSIUM (ug/L)	***	***	***	***	***	***	***	***	***	***	***	32000
POTASSIUM, TOTAL (ug/L)	***	***	***	***	***	***	***	***	***	***	***	40000
SELENIUM (ug/L)	***	***	***	***	***	***	***	***	***	***	***	<4
SELENIUM, TOTAL (ug/L)	***	***	***	***	***	***	***	***	***	***	***	<2.0
SILVER (ug/L)	***	***	***	***	***	***	***	***	***	***	***	<30
SILVER, TOTAL (ug/L)	***	***	***	***	***	***	***	***	***	***	***	<30
SODIUM (ug/L)	***	***	140000	101000	6800000	5970000	778000	691000	768000	425500	113000	115000
SODIUM, TOTAL (ug/L)	***	***	***	***	***	***	***	***	***	***	***	121000
SPECIFIC CONDUCTANCE, FIELD (umhos/cm)	***	***	1558	1290	9493	>20000	4730	5988	5385	5038	2543	2308
SULFATE AS SO4 (mg/L)	***	***	480	350	65	190	700	670	670	1150	<10	<10.0
SULFIDE AS S (mg/L)	***	***	***	***	***	***	***	***	***	***	***	2.000
TEMPERATURE (DEG. C)	***	***	11.6	12.5	7.60	9.80	8.7	11.9	10.4	13.7	9.7	10.9
THALLIUM (ug/L)	***	***	***	***	***	***	***	***	***	***	***	<300
THALLIUM, TOTAL (ug/L)	***	***	***	***	***	***	***	***	***	***	***	<300
TIN (ug/L)	***	***	***	***	***	***	***	***	***	***	***	<1000
TIN, TOTAL (ug/L)	***	***	***	***	***	***	***	***	***	***	***	<1000
VANADIUM (ug/L)	***	***	***	***	***	***	***	***	***	***	***	<10
VANADIUM, TOTAL (ug/L)	***	***	***	***	***	***	***	***	***	***	***	<10
ZINC (ug/L)	***	***	***	***	***	***	***	***	***	***	***	107000
ZINC, TOTAL (ug/L)	***	***	***	***	***	***	***	***	***	***	***	71*

< = Parameter less than the ETC IDL

\* = Concentration reported below the PMDL

\*\*\* = Parameter not tested for/no available data

AUGUST, 1987

873-2096

TABLE 3 SHEET 2A  
RESULTS OF THE 1987 INORGANIC ANALYSIS  
WELL AND IMPOUNDMENT DATA  
SCA CHICAGO INCINERATOR GROUND-WATER ASSESSMENT

	SAMPLE POINT DATE	G-121S 870128	G-121S 870429/ 870430	G-122S 870128	G-122S 870429	G-123S 870128	G-123S 870429/ 870430	G-124S 870128	G-124S 870429/ 870430	G-125S 870128	G-125S 870429	IMPDE 851029	IMPDE 870501	AVERAGED 1985 IMPOUNDMENTS
ALUMINUM (ug/L)	1	***	<30	***	***	***	<30	***	<30	***	***	***	***	***
ALUMINUM, TOTAL (ug/L)	1	***	<30	***	***	***	437	***	<30	***	***	***	3150	***
ANTIMONY (ug/L)	1	***	<500	***	***	***	<500	***	<500	***	***	<50	***	***
ANTIMONY, TOTAL (ug/L)	1	***	<500	***	***	***	<500	***	<500	***	***	***	<500	***
ARSENIC (ug/L)	1	***	16*	***	***	***	4*	***	<4.0	***	***	48*	***	48*
ARSENIC, TOTAL (ug/L)	1	***	<20	***	***	***	<4.0	***	<4.0	***	***	***	190*	***
BARIUM (ug/L)	1	***	203*	***	***	***	253*	***	88*	***	***	***	***	***
BARIUM, TOTAL (ug/L)	1	***	246*	***	***	***	282*	***	99.0*	***	***	***	266*	***
BERYLLIUM (ug/L)	1	***	<1	***	***	***	<1	***	<1	***	***	***	***	***
BERYLLIUM, TOTAL (ug/L)	1	***	1.00*	***	***	***	<1.0	***	<1.0	***	***	***	<1.0	***
CADMIUM (ug/L)	1	***	<3	***	***	***	<3	***	<3	***	***	23*	***	23*
CADMIUM, TOTAL (ug/L)	1	***	<3.0	***	***	***	<3.0	***	<3.0	***	***	***	5.00*	***
CALCIUM (ug/L)	1	***	15000	***	***	***	82700	***	199200	***	***	***	***	27220
CALCIUM, TOTAL (ug/L)	1	***	398000	***	***	***	76100	***	374000	***	***	***	11700	***
CHLORIDE (mg/L)	1	10000	1.00	390	5300	1700	1800	410	470	1000	1400	***	***	13186
CHROMIUM (ug/L)	1	***	<20	***	***	***	<20	***	<20	***	***	130*	***	130*
CHROMIUM, TOTAL (ug/L)	1	***	34.0*	***	***	***	<20	***	<20	***	***	***	47.0*	***
CHROMIUM HEXAVALENT (ug/L)	1	***	***	***	***	***	***	***	***	***	***	***	<20	***
COBALT (ug/L)	1	***	<20	***	***	***	<20	***	<20	***	***	***	***	***
COBALT, TOTAL (ug/L)	1	***	<20	***	***	***	<20	***	<20	***	***	***	<20	***
COPPER (ug/L)	1	***	<20	***	***	***	<20	***	<20	***	***	***	***	***
COPPER, TOTAL (ug/L)	1	***	<20	***	***	***	<20	***	<20	***	***	***	136*	***
CYANIDE, TOTAL (mg/L)	1	***	0.02*	***	***	***	<0.02	***	<0.02	***	***	<0.01	<0.020	***
FLUORIDE (mg/L)	1	***	2.6	***	***	***	0.42*	***	0.48*	***	***	***	70.0	***
IRON (ug/L)	1	102	140	102	***	<30	69*	<30	37*	<30	102	***	***	***
IRON TOTAL (ug/L)	1	***	990	***	884	***	828	***	280	***	***	***	1270	683
LEAD (ug/L)	1	***	6*	***	***	***	5*	***	<4	***	***	207	***	207
LEAD, TOTAL (ug/L)	1	***	<10	***	***	***	20*	***	56.0*	***	***	***	136*	***
MAGNESIUM (ug/L)	1	***	2890	***	***	***	169000	***	160000	***	***	***	***	4152
MAGNESIUM, TOTAL (ug/L)	1	***	124000	***	***	***	154000	***	61900	***	***	***	1520*	***

< = Parameter less than the ETC IDL

\* = Concentration reported below the PMDL

\*\*\* = Parameter not tested for/no available data

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TABLE 3 SHEET 2B  
RESULTS OF THE 1987 INORGANIC ANALYSIS  
WELL AND IMPOUNDMENT DATA  
SCA CHICAGO INCINERATOR GROUND-WATER ASSESMENT

	SAMPLE POINT	G-121S	G-121S	G-122S	G-122S	G-123S	G-123S	G-124S	G-124S	G-125S	G-125S	IMPDE	IMPDE	AVERAGED 1985
	DATE	870128	870429/ 870430	870128	870429	870128	870429/ 870430	870128	870429/ 870430	870128	870429	851029	870501	IMPOUNDMENTS
MANGANESE (ug/L)	1	1230	697	1360	***	98	93	1910	1380	2490	2250	***	***	50
MANGANESE, TOTAL (ug/L)	1	***	668	***	1380	***	120	***	1590	***	***	***	17.0*	***
MERCURY (ug/L)	1	***	<0.5	***	***	***	<0.5	***	<0.5	***	***	0.5*	***	0.5*
MERCURY, TOTAL (ug/L)	1	***	<0.50	***	***	***	<0.50	***	<0.50	***	***	***	4.80*	***
NICKEL (ug/L)	1	***	<20	***	***	***	24*	***	32*	***	***	51*	***	51*
NICKEL, TOTAL (ug/L)	1	***	28*	***	***	***	25.0*	***	21.0*	***	***	***	<20	***
OSMIUM, (mg/L)	1	***	***	***	***	***	***	***	***	***	***	***	***	***
OSMIUM, TOTAL (mg/L)	1	***	***	***	***	***	***	***	***	***	***	***	***	***
pH, FIELD	1	8.38	8.30	7.33	7.47	8.97	8.69	7.64	7.81	7.67	7.66	***	9.01	8.90
POTASSIUM (ug/L)	1	***	280000	***	***	***	229000	***	***	***	***	***	***	68000
POTASSIUM, TOTAL (ug/L)	1	***	350000	***	***	***	290000	***	57000	***	***	***	22000	***
SELENIUM (ug/L)	1	***	<4	***	***	***	<4	***	<4	***	***	***	***	***
SELENIUM, TOTAL (ug/L)	1	***	<2.0	***	***	***	<2.0	***	<2.0	***	***	***	6.0*	***
SILVER (ug/L)	1	***	<30	***	***	***	<30	***	<30	***	***	***	***	***
SILVER, TOTAL (ug/L)	1	***	<30	***	***	***	<30	***	<30	***	***	***	***	***
SODIUM (ug/L)	1	12900000	5340000	3980000	***	843000	695000	167000	159000	364000	342000	***	***	9172857
SODIUM, TOTAL (ug/L)	1	***	5810000	***	2420000	***	730000	***	192000	***	***	***	3920000	***
SPECIFIC CONDUCTANCE, FIELD (umhos/cm)	1	8260	>20000	5940	15250	4615	5023	2275	2693	3633	4688	***	16800	20440
SULFATE AS SO4 (mg/L)	1	670	820	430	320	220	110	890	910	880	910	***	***	***
SULFIDE AS S (mg/L)	1	***	1.4	***	***	***	1.8	***	<0.1	***	***	***	<0.10	***
TEMPERATURE (DEG. C)	1	10.9	12.0	23.7	24.4	10.4	11.3	17.2	17.7	10.8	11.9	***	52.9	26.8
THALLIUM (ug/L)	1	***	<300	***	***	***	<300	***	<300	***	***	***	***	***
THALLIUM, TOTAL (ug/L)	1	***	<300	***	***	***	<300	***	<300	***	***	***	<300	***
TIN (ug/L)	1	***	<1000	***	***	***	<1000	***	<1000	***	***	***	***	***
TIN, TOTAL (ug/L)	1	***	<1000	***	***	***	<1000	***	<1000	***	***	***	<1000	***
VANADIUM (ug/L)	1	***	<10	***	***	***	<10	***	<10	***	***	***	***	***
VANADIUM, TOTAL (ug/L)	1	***	<10	***	***	***	<10	***	<10	***	***	***	44.0	***
ZINC (ug/L)	1	***	837	***	***	***	303000	***	234000	***	***	***	***	***
ZINC, TOTAL (ug/L)	1	***	73.0*	***	***	***	<20	***	<20	***	***	***	416	***

< = Parameter less than the ETC IDL

\* = Concentration reported below the PMDL

\*\*\* = Parameter not tested for/no available data

AUGUST, 1987

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TABLE 5

COMPARISON OF THE CONCENTRATION OF ALL INORGANIC  
PARAMETERS REPORTED IN THE IMPOUNDMENTS IN 1987 WITH MONITORING WELLS  
SCA CHICAGO INCINERATOR GROUND-WATER ASSESSMENT

SAMPLE POINT DATE	G-120S 870430	G-121S 870430	G-123S 870430	G-124S 870430	IMPDE 870501
ALUMINUM, TOTAL (ug/L)	H	H	H	H	3150
ANTIMONY, TOTAL (ug/L)	E	E	E	E	<6980
ARSENIC, TOTAL (ug/L)	H	H	H	H	190
BARIUM, TOTAL (ug/L)	L	H	L	H	266
BERYLLIUM, TOTAL (ug/L)	E	E	E	E	<14
CADMIUM, TOTAL (ug/L)	E	E	E	E	5*
CALCIUM, TOTAL (ug/L)	L	L	L	L	11700
CHROMIUM, TOTAL (ug/L)	E	E	E	E	47*
COPPER, TOTAL (ug/L)	E	E	E	E	<276
CYANIDE, TOTAL (mg/L)	E	E	E	E	<0.2
FLUORIDE (mg/L)	H	H	H	H	70.00
IRON (ug/L)	L	H	H	H	1270
LEAD, TOTAL (ug/L)	H	H	H	H	136
MAGNESIUM, TOTAL (ug/L)	L	L	L	L	1520
MANGANESE, TOTAL (ug/L)	L	L	L	L	17.00
MERCURY, TOTAL (ug/L)	E	E	E	E	4.8*
NICKEL, TOTAL (ug/L)	E	E	E	E	<276
OSMIUM, TOTAL (mg/L)	E	E	E	E	***
pH, FIELD	H	H	H	H	9.01
POTASSIUM, TOTAL (ug/L)	L	L	L	L	22000
SELENIUM, TOTAL (ug/L)	E	E	E	E	6*
SILVER, TOTAL (ug/L)	E	E	E	E	<422
SODIUM, TOTAL (ug/L)	H	L	H	H	3920000
SPECIFIC CONDUCTANCE, FIELD (umhos/cm)	H	L	H	H	16800
THALLIUM, TOTAL (ug/L)	E	E	E	E	<4190
TIN, TOTAL (ug/L)	E	E	E	E	<14000
VANADIUM, TOTAL (ug/L)	E	E	E	E	44*
ZINC, TOTAL (ug/L)	H	H	H	H	416

TABLE 5 (CONTINUED)

- L = Concentration of parameter is lower in the impoundments than the wells  
H = Concentration of parameter is higher in the impoundments than the wells  
E = Concentration of parameter in the impoundments and wells  
is below the Practical Method Detection Limit  
\*\*\* = Not analyzed for  
< = less than MDL. Value given is PMDL  
\* = Value reported is below the Practical Method Detection Limit

NOTE: The field pH and the field specific conductance for the monitoring wells were actually measured on April 29, 1987

TABLE 6  
ORGANIC COMPOUNDS EXCEEDING THE IDL IN APRIL 1987  
SCA CHICAGO INCINERATOR GROUND-WATER ASSESSMENT

COMPOUND	SAMPLE POINTS					DETECTION LIMITS	
	1205 870430	1215 870430	1235 870430	1245 870430	1MPDE 870501	PMDL ug/l	
1,1-DICHLOROETHYLENE	(ug/l): NO	NO	18.5	NO	NO	62.9	
1,2-DICHLOROBENZENE	(ug/l): NO	6.93	NO	NO	NO	214	
1,4-DIOXANE	(ug/l): NO	57.2	NO	NO	NO	140	
2,4-DICHLOROPHENOL	(ug/l): NO	16.8	NO	NO	NO	182	
2,4-DIMETHYLPHENOL	(ug/l): NO	54.6	NO	NO	NO	180	
2,6-DICHLOROPHENOL	(ug/l): NO	17.0	NO	NO	NO	*	
2-CHLOROPHENOL	(ug/l): NO	24.7	NO	NO	NO	198	
4,4'-DDE	(ug/l): 0.980	NO	NO	0.236	0.117	3.80	
4,4'-DDT	(ug/l): NO	0.475	0.334	0.737	0.509	24.9	
ACETONE	(ug/l): 10.7	22.2	20.0	18.0	28.0	140	
ANILINE	(ug/l): NO	38.5	NO	NO	NO	*	
ANTHRACENE	(ug/l): NO	2.07	NO	NO	NO	221	
BENZENE	(ug/l): NO	371**	6.40	NO	NO	47.7	
CHLORANILINE,p	(ug/l): NO	466	NO	NO	NO	*	
CHLOROBENZENE	(ug/l): NO	93.4**	NO	NO	NO	43.5	
CRESOL,m+p	(ug/l): NO	30.4	NO	NO	NO	*	
DICHLORODIFLUOROMETHANE	(ug/l): 43.8	NO	NO	NO	NO	140	
ETHYLBENZENE	(ug/l): NO	19.8	NO	NO	NO	51.8	
METHYLENE CHLORIDE	(ug/l): NO	NO	5.27	NO	NO	51.1	
NAPHTHALENE	(ug/l): 4.08	214**	NO	NO	NO	208	
PHENOL	(ug/l): NO	17.1	NO	NO	NO	156	
TOLUENE	(ug/l): NO	59.5**	NO	NO	NO	33.2	
VINYL CHLORIDE	(ug/l): NO	NO	13.9	NO	NO	138	
XYLENE,m	(ug/l): NO	16.5	NO	NO	NO	140	
XYLENE,otp	(ug/l): NO	24.0	NO	NO	NO	140	

NOTES:

- NO = NONE DETECTED
- \* = CALCULATED PMDL GREATER THAN 500ug/l, COMPOUND CONSIDERED TO HAVE NO DEFENDABLE PMDL
- \*\* = EXCEEDS THE CALCULATED PMDL
- ACETONE, 4,4'-DDE AND 4,4'-DDT RESULTS ARE INVALID DUE TO LABORATORY CONTAMINATION REPORTED IN THE QUALITY CONTROL DATA.
- METHYLENE CHLORIDE IS A COMMON LABORATORY CONTAMINANT AND THE REPORTED RESULTS ARE CONSIDERED TO BE INVALID AND HAVE BEEN REJECTED.

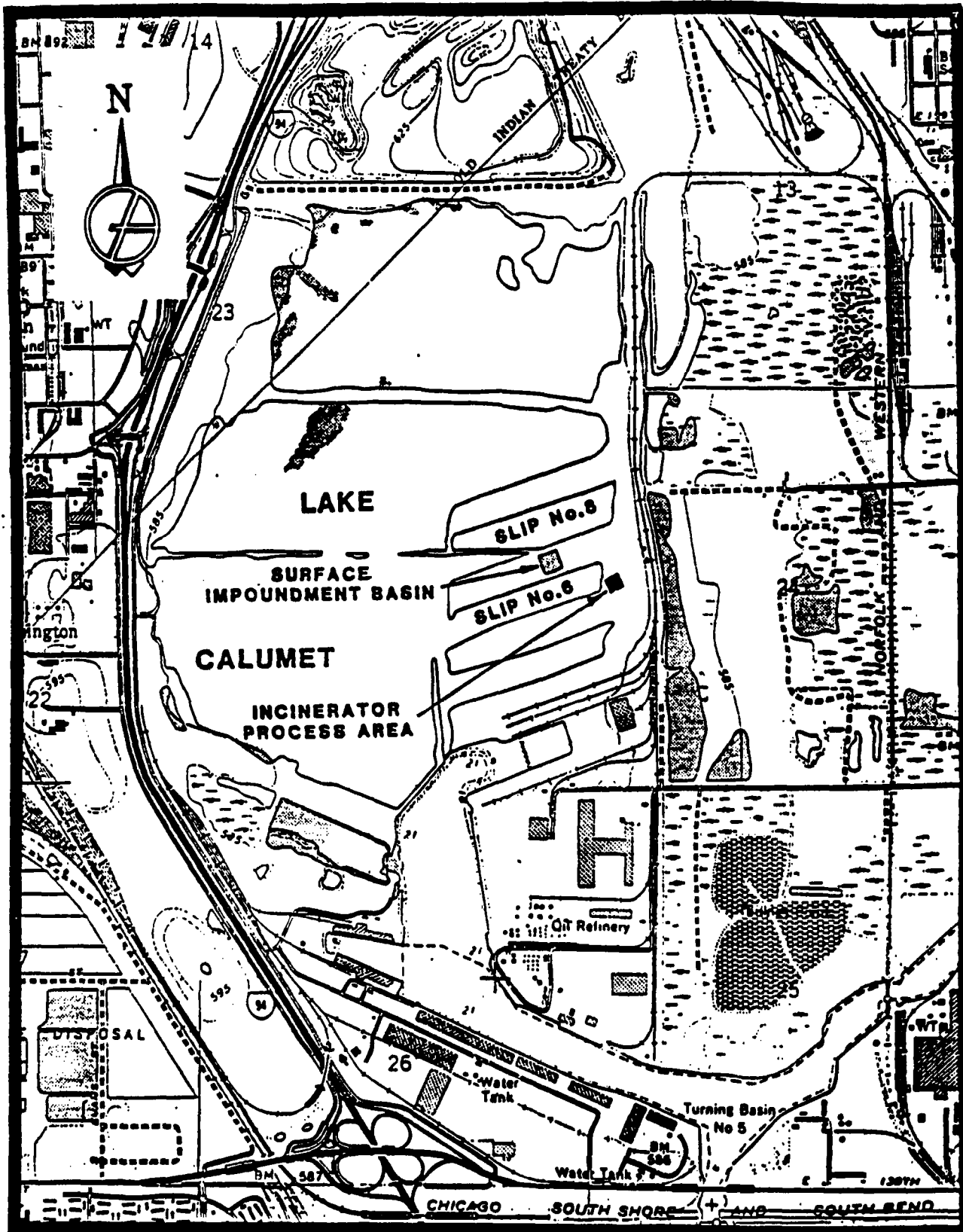
TABLE 7

CALCULATION OF SPECIFIC CONDUCTANCE  
FOR THOSE WELLS GREATER THAN 20000 umhos/cm USING NA AND CL VALUES  
SCA CHICAGO INCINERATOR GROUND-WATER ASSESSMENT

Well	Date	Na mg/l	NaCl mg/l calc	Sp Cond umhos/cm	Cl mg/l	NaCl mg/l calc	Sp Cond umhos/cm	Max calc umhos/cm	Sp Con umhos/cm
G-122P	11/21/85	5730	14574	22100	13000	21423	31700		31700
G-111	2/21/85	1720	4375	7000	7170	11815	18200		18200
G-112B	2/21/85	5540	14091	21800	8500	14007	21000		21800
G-112B	5/16/85	12800	32557	46600	17800	29332	42200		46600
G-121P	11/21/85	7620	19381	28900	13000	21423	31700		31700
G-121S	11/21/85	6220	15820	24300	11000	18127	27200		27200
G-121S	2/14/86	5880	14956	23100	11000	18127	27200		27200
G-121S	5/16/86	5880	14956	23100	1*	2*	0*		23100
G-121S	4/29/87	5340	13582	21200	1*	2*	0*		21200
G-122S	11/21/85	3310	8419	13600	6900	11370	17900		17900
Impde/E	2/21/85	10700	27215	39000	14000	23070	34000		39000
Impde/N	5/15/85	10600	26961	39000	17800	29332	42300		42300
Impde/S	5/15/85	11500	29250	42400	17000	28014	40600		42400
Impde/W	2/21/85	5440	13837	21000	7100	11700	18100		21000
Impde/W	5/15/85	11500	29250	42400	17000	28014	40600		42400
G-111A	5/15/86	6160	15668	23900	10000	16479	24900		24900
G-111A	4/29/87	5970	15185	23200	1	2	0		23200

**NOTE:** The Chloride data for G-121S on 5/16/86 and 4/29/87 and for G-111A on 4/29/87 is inconsistent with the Sodium concentrations for these wells as shown on the time-trend plots, Figures 9-10 and 9-14. Based on internal QA/QC review, a Quality Assurance Report (QAR) has been forwarded to ETC for evaluation. At time of this assessment report, response to QAR has not been received.





0 2000 4000  
SCALE IN FEET

BASE MAP: MODIFIED FROM U.S.G.S. 7 1/2-MIN. QUAD  
LAKE CALUMET, ILL.-IND., 1965  
(PHOTOREVISED 1973)

OS NO. 873-2096	SCALE AS SHOWN
DRAWN BDL	DATE 7/28/87
CHECKED LWK	DWG. NO.

**Golder Associates**

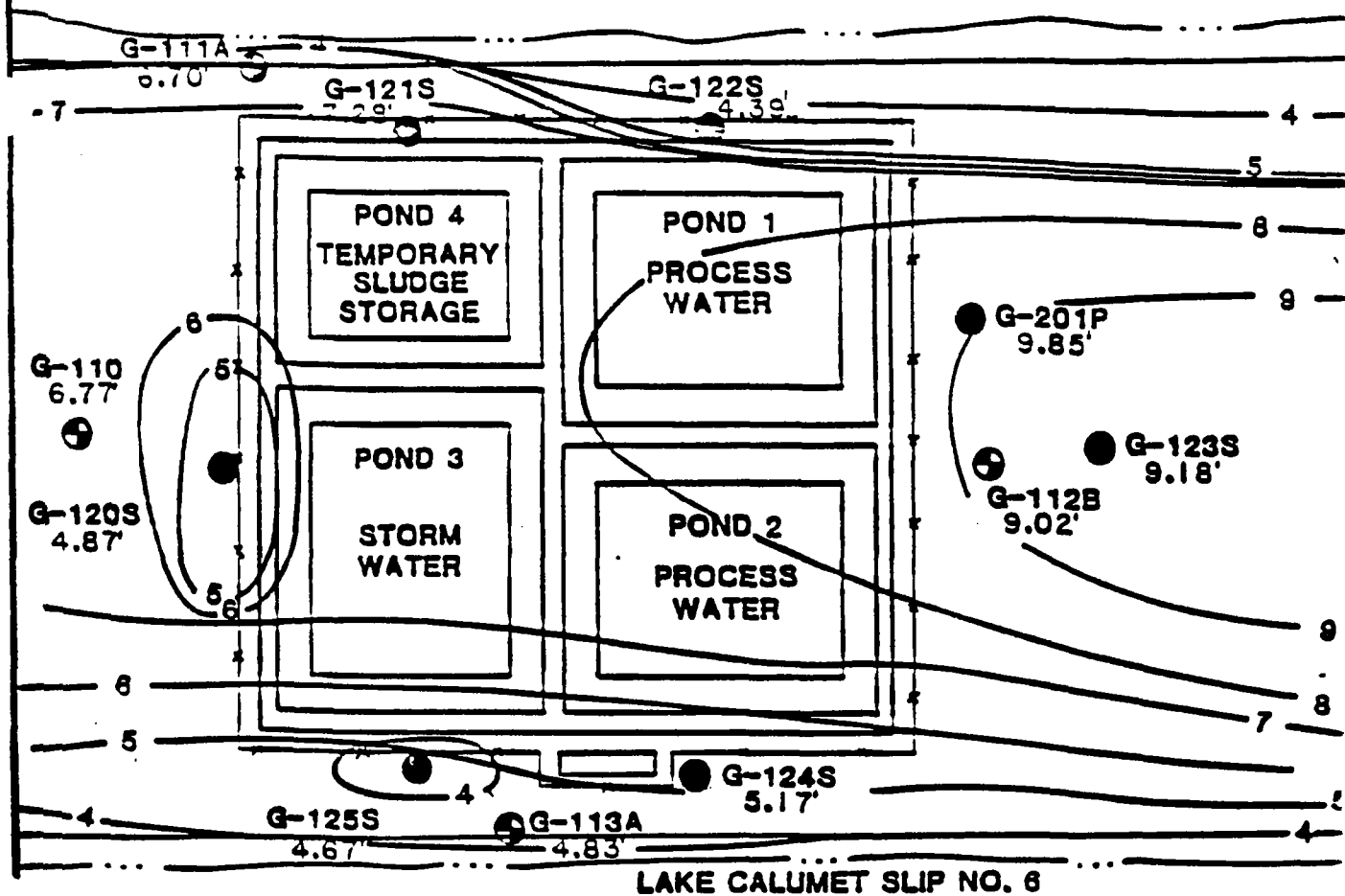
**SITE LOCATION MAP**

**SCA CHICAGO INCINERATOR**

**FIGURE 1**

GRAPHIX 232360

# LAKE CALUMET SLIP NO. 8



- G-110 WELL NUMBER
- 6.77 WATER LEVEL ELEVATION
- 5 — POTENTIOMETRIC SURFACE (IN FEET)

NOTES: (1) WATER LEVELS FROM APRIL 29 & 30, 1987  
 (2) WATER LEVEL ELEVATIONS ARE REFERENCED TO CHICAGO CITY DATUM. 0.00 FEET (CHICAGO CITY DATUM) = 579.88 FEET (MSL)

0 100' 200' 300'  
 SCALE IN FEET

232360  
 GRAPHIX

JOB NO. 873-209	SCALE 1"=100'
DRAWN BDL	DATE 7/31/87
CHECKED WMK	DWG. NO.

**Golder Associates**

**POTENTIOMETRIC MAP  
 OF IMPOUNDMENT BASIN AREA**

SCA CHICAGO INCINERATOR

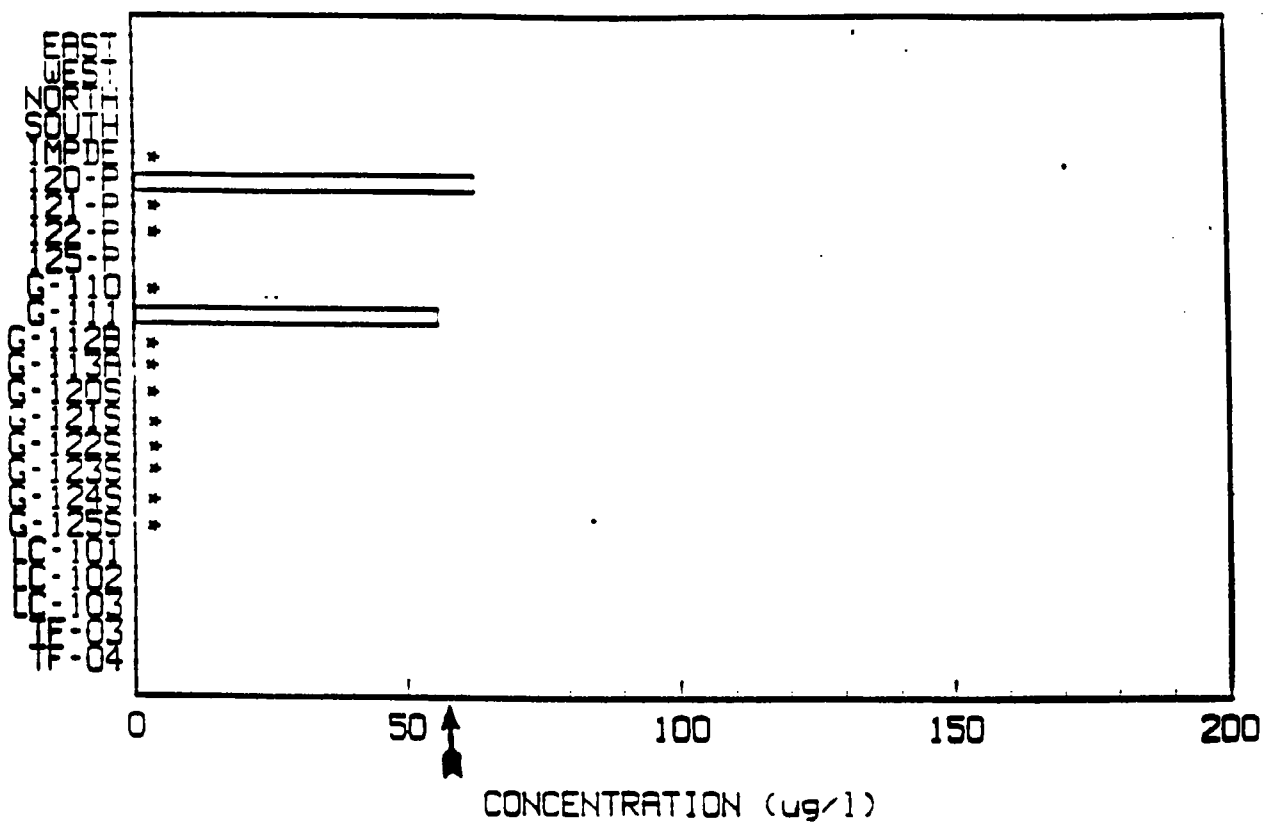
FIGURE 5

\* BELOW METHOD DETECTION LIMIT

NOTE: NO PRACTICAL METHOD DETECTION LIMIT CALCULATED

JOB NO.	873-2096	SCALE	N.T.S.	FINGERPRINTS of INORGANIC D CONCENTRATION vs.LOCATIC
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWS NO		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.

ARSENIC  
10/29/85 - 11/23/85

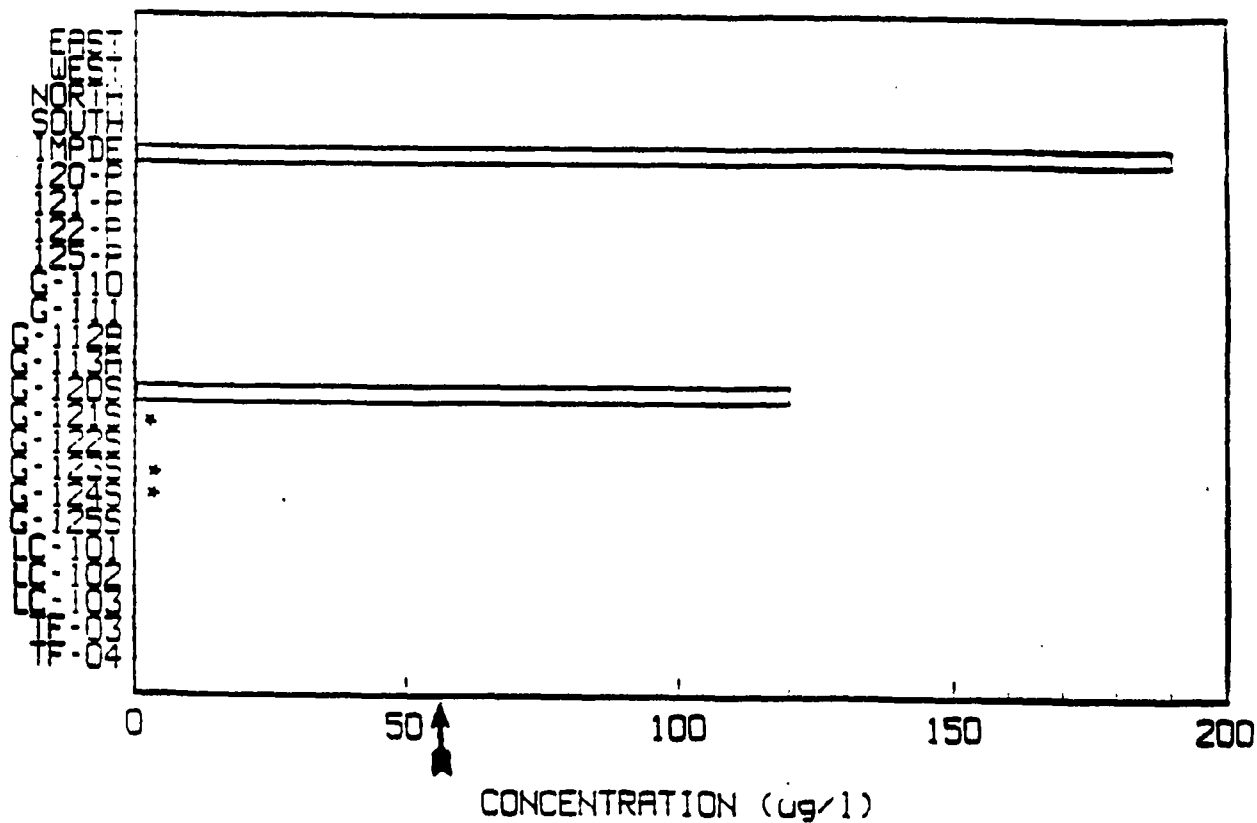


LEGEND

- \* BELOW PRACTICAL METHOD DETECTION LIMIT
- ↑ PRACTICAL METHOD DETECTION LIMIT (PMDL)

JOB NO.	873-2096	SCALE	N.T.S.	FINGERPRINTS of INORGANIC DATA CONCENTRATION vs. LOCATION
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 6

ARSENIC, TOTAL  
04/30/87 - 05/01/87

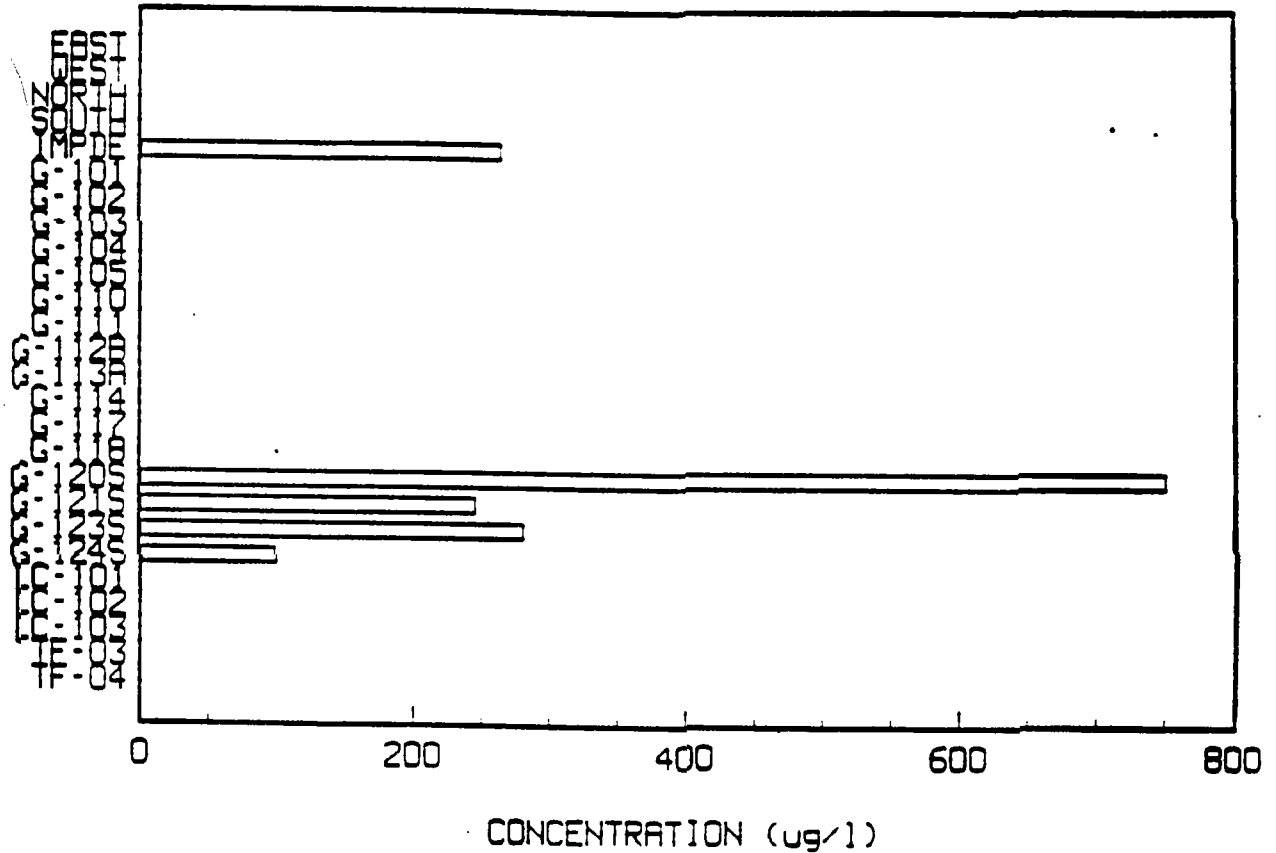


LEGEND

- \* BELOW PRACTICAL METHOD DETECTION LIMIT
- ↑ PRACTICAL METHOD DETECTION LIMIT (PMDL)

JOB NO.	873-2096	SCALE	N.T.S.	FINGERPRINTS of INORGANIC DA CONCENTRATION vs. LOCATION
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG. NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. <span style="float: right;">FIGURE</span>

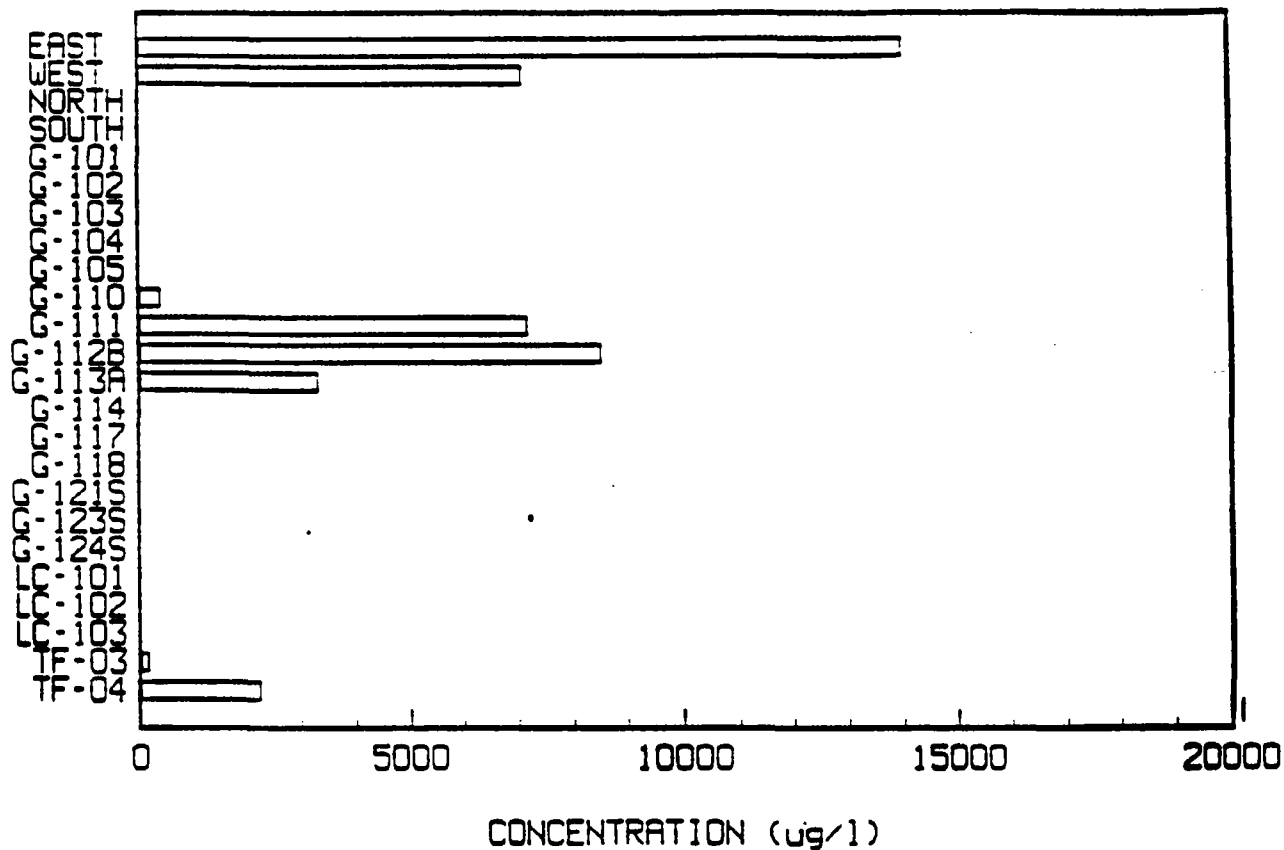
BARIUM, TOTAL  
04/30/87 - 05/01/87



NOTE: NO PRACTICAL METHOD DETECTION LIMIT CALCULATED

JOB NO.	873-2096	SCALE	N.T.S.	FINGERPRINTS of INORGANIC DATA CONCENTRATION vs. LOCATION
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWS. NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 6-

CHLORIDE  
02/21/85



NOTE: NO PRACTICAL METHOD DETECTION LIMIT CALCULATED

JOB NO.	873-2096	SCALE	N.T.S.	FINGERPRINTS of INORGANIC DATA CONCENTRATION vs.LOCATION
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG. NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 6-5

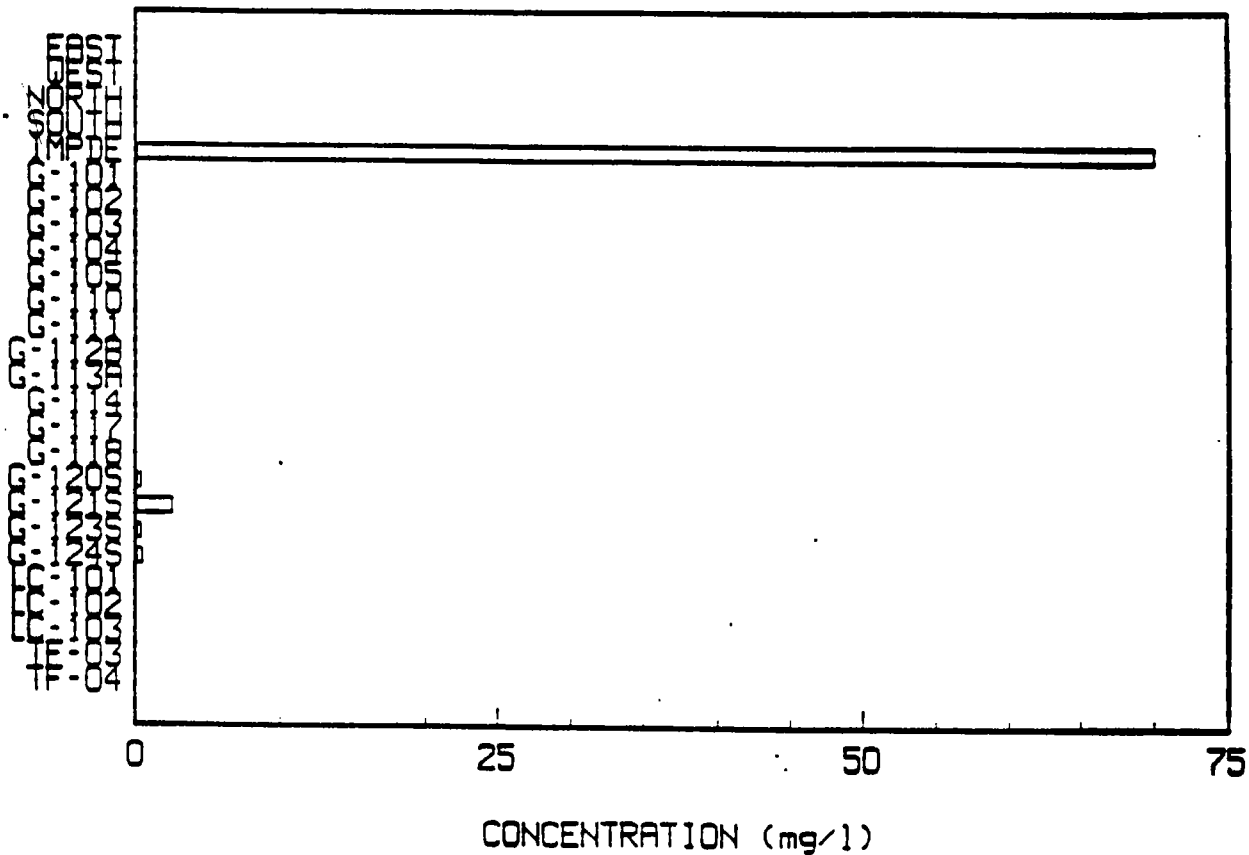




Metal	Sample 1 Concentration (µg/l)	Sample 2 Concentration (µg/l)
Pb	~100	~100
Cd	~100	~100
Cr	~100	~100
Ni	~100	~100
Cu	~100	~100
Zn	~100	~100
Mn	~100	~100
Fe	~100	~100
Al	~100	~100
Si	~100	~100
Ti	~100	~100
U	~100	~100
Sr	~100	~100
Ba	~100	~100
K	~100	~100
Na	~100	~100
Ca	~100	~100
Mg	~100	~100

JOB NO.	873-2096	SCALE	N.T.S.	FINGERPRINTS of INORGANIC DATA CONCENTRATION vs.LOCATION	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 6-7

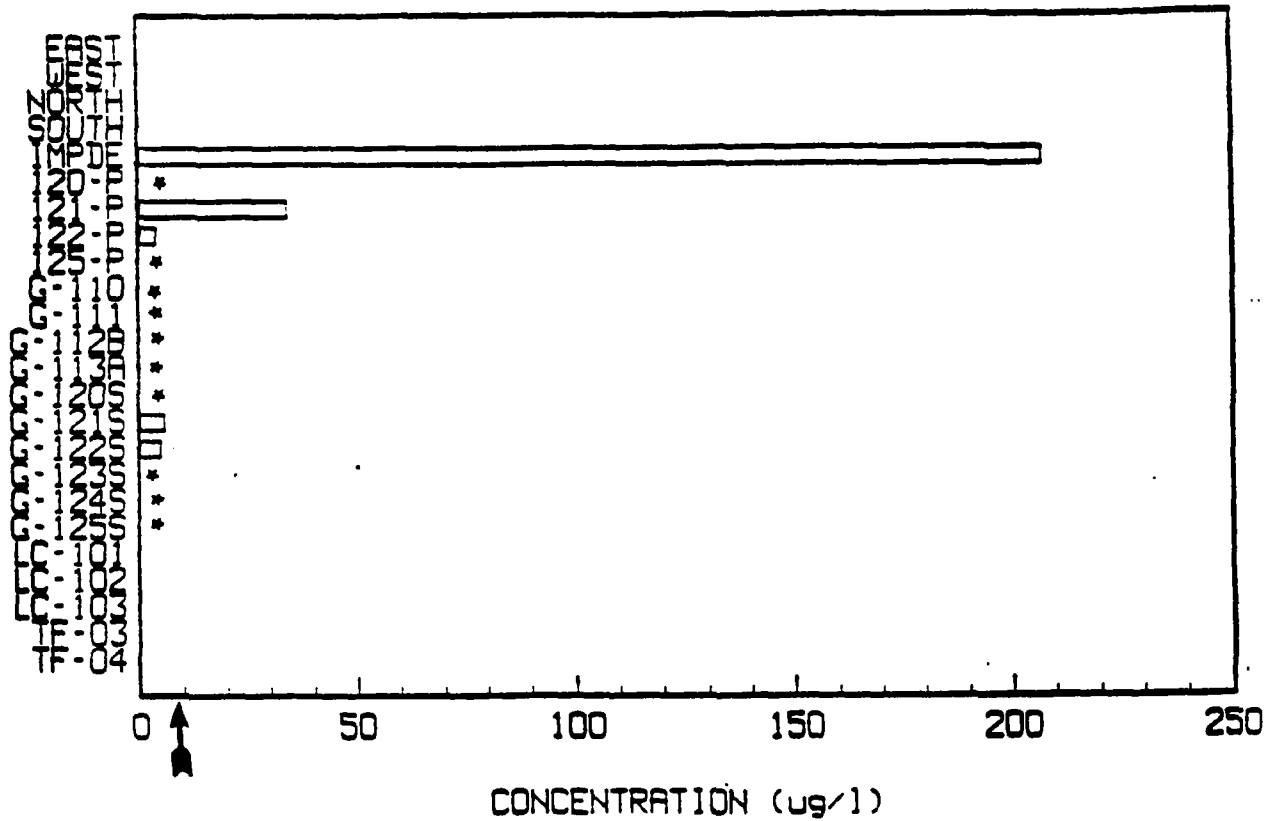
FLUORIDE  
04/30/87 - 05/01/87



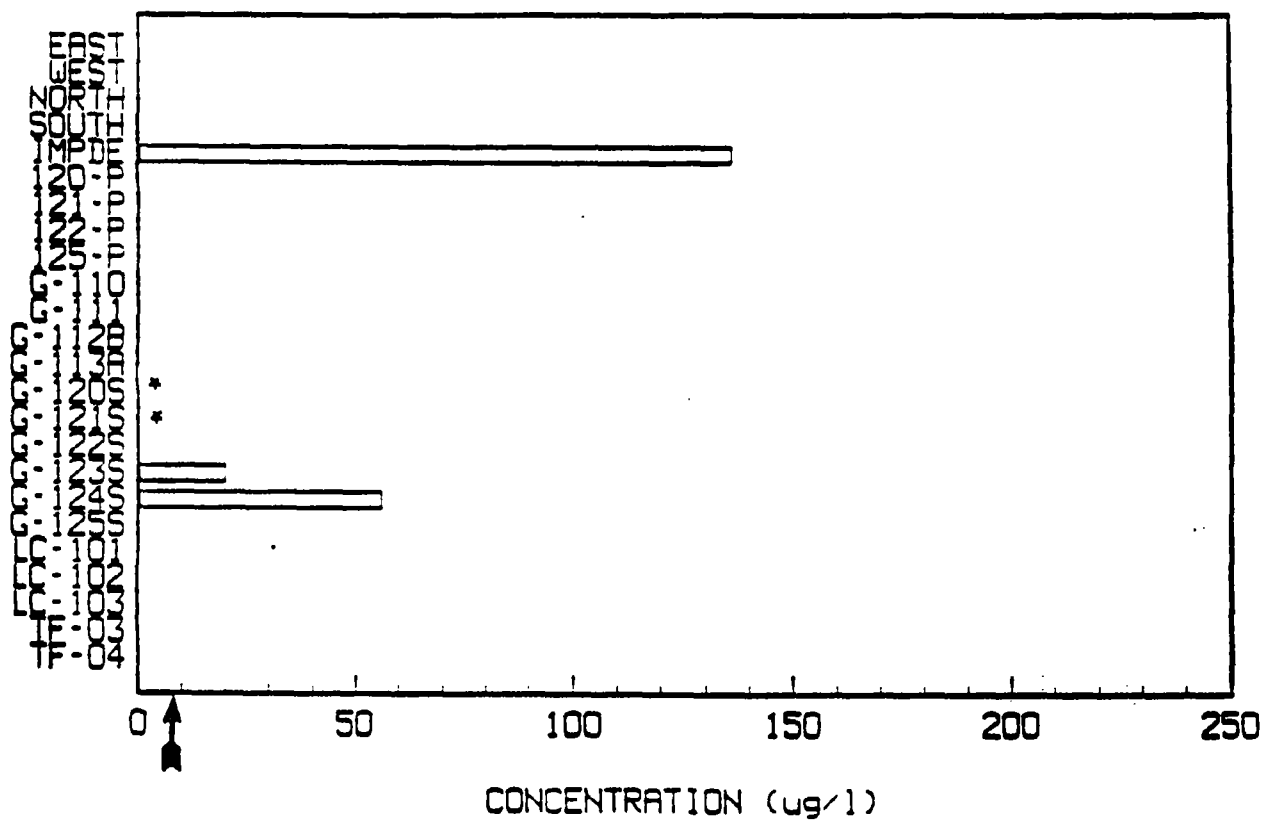
NOTE: NO PRACTICAL METHOD DETECTION LIMIT CALCULATED

JOB NO.	873-2096	SCALE	N.T.S.	FINGERPRINTS of INORGANIC DATA CONCENTRATION vs.LOCATION
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG. NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 6-

LEAD  
10/29/85 - 11/23/85



LEAD, TOTAL  
04/30/87 - 05/01/87



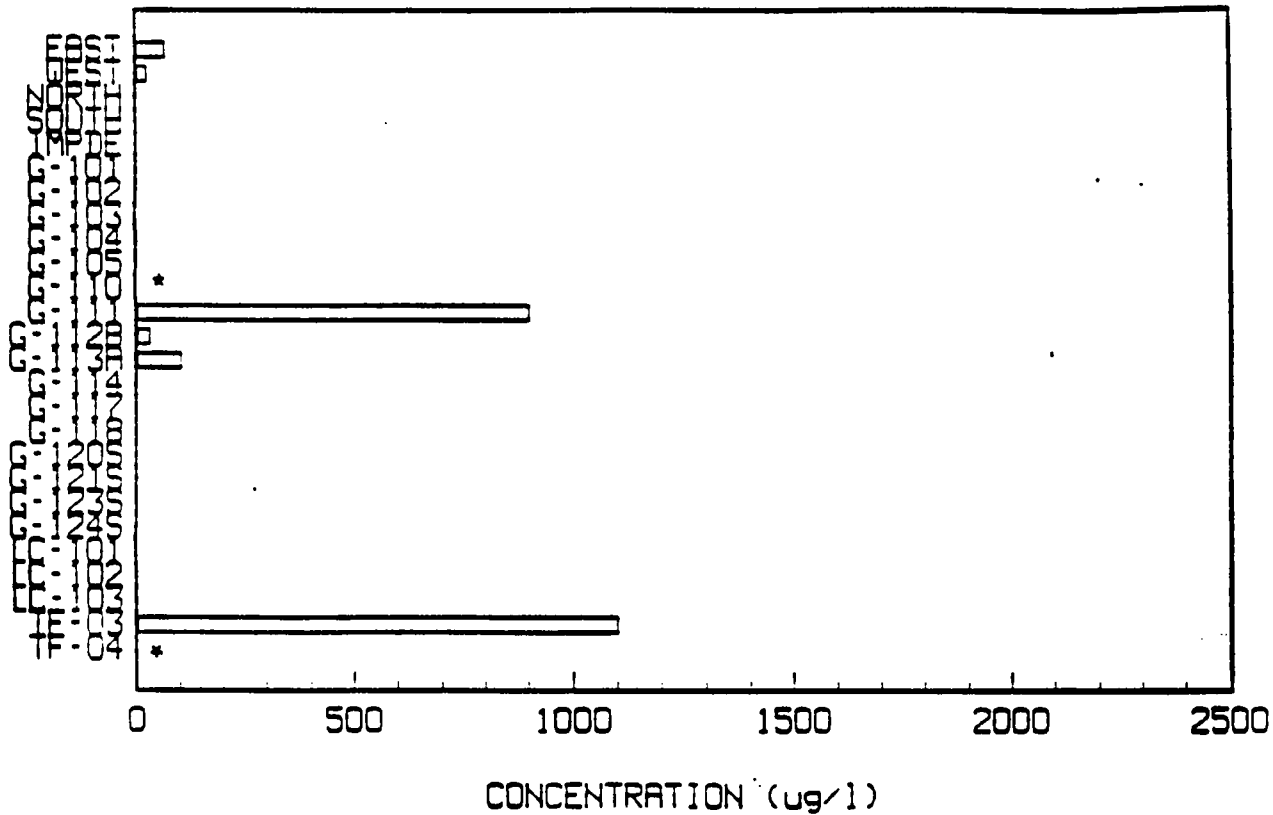
# LEGEND

\* BELOW PRACTICAL METHOD DETECTION LIMIT

↑ PRACTICAL METHOD DETECTION LIMIT (PMDL)

JOB NO.	873-2096	SCALE	N.T.S.	FINGERPRINTS of INORGANIC DATA CONCENTRATION vs. LOCATION
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG. NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 6-

MANGANESE  
02/21/85



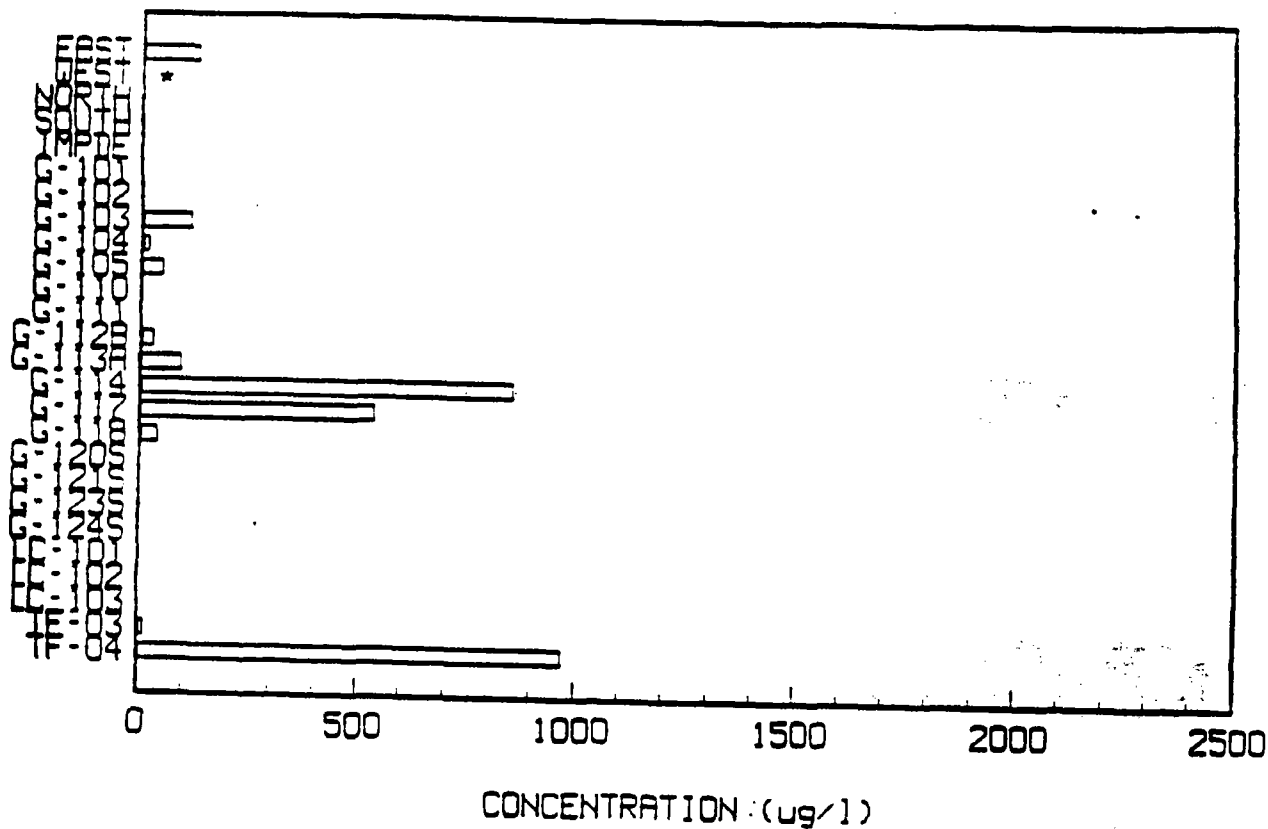
### LEGEND

\* BELOW METHOD DETECTION LIMIT

NOTE: NO PRACTICAL METHOD DETECTION LIMIT CALCULATED

JOB NO	873-2096	SCALE	N.T.S.	FINGERPRINTS of INORGANIC DATA CONCENTRATION vs. LOCATION
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG NO		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 6-

MANGANESE  
04/09/85 - 04/10/85



# LEGEND

\* BELOW METHOD DETECTION LIMIT

NOTE: NO PRACTICAL METHOD DETECTION LIMIT CALCULATED

JOB NO	873-2096	SCALE	N.T.S.	FINGERPRINTS of INORGANIC DATA CONCENTRATION vs. LOCATION
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG NO		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 6-

Horizontal bar chart showing the concentration of various metals in water and sediment samples. The x-axis represents concentration in  $\mu\text{g/l}$ , ranging from 0 to 2500. The y-axis lists metals: Ag, As, Ba, Be, Bi, Br, Cd, Co, Cr, Cu, Fe, Hg, Mn, Mo, Ni, Pb, Se, Sn, Ti, V, Zn. For each metal, there are two bars: a solid black bar for water and a hatched bar for sediment. Asterisks indicate concentrations below the detection limit.

Metal	Water Concentration ( $\mu\text{g/l}$ )	Sediment Concentration ( $\mu\text{g/l}$ )
Ag	~10	~10
As	~10	~10
Ba	~10	~10
Be	~10	~10
Bi	~10	~10
Br	~10	~10
Cd	~10	~10
Co	~10	~10
Cr	~10	~10
Cu	~10	~10
Fe	~10	~10
Hg	~10	~10
Mn	~10	~10
Mo	~10	~10
Ni	~10	~10
Pb	~10	~10
Se	~10	~10
Sn	~10	~10
Ti	~10	~10
V	~10	~10
Zn	~10	~10

NOTE: NO PRACTICAL METHOD DETECTION LIMIT CALCULATED

JOB NO.	873-2096	SCALE	N.T.S.	FINGERPRINTS of INORGANIC DATA CONCENTRATION vs.LOCATION	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG NO			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 6-

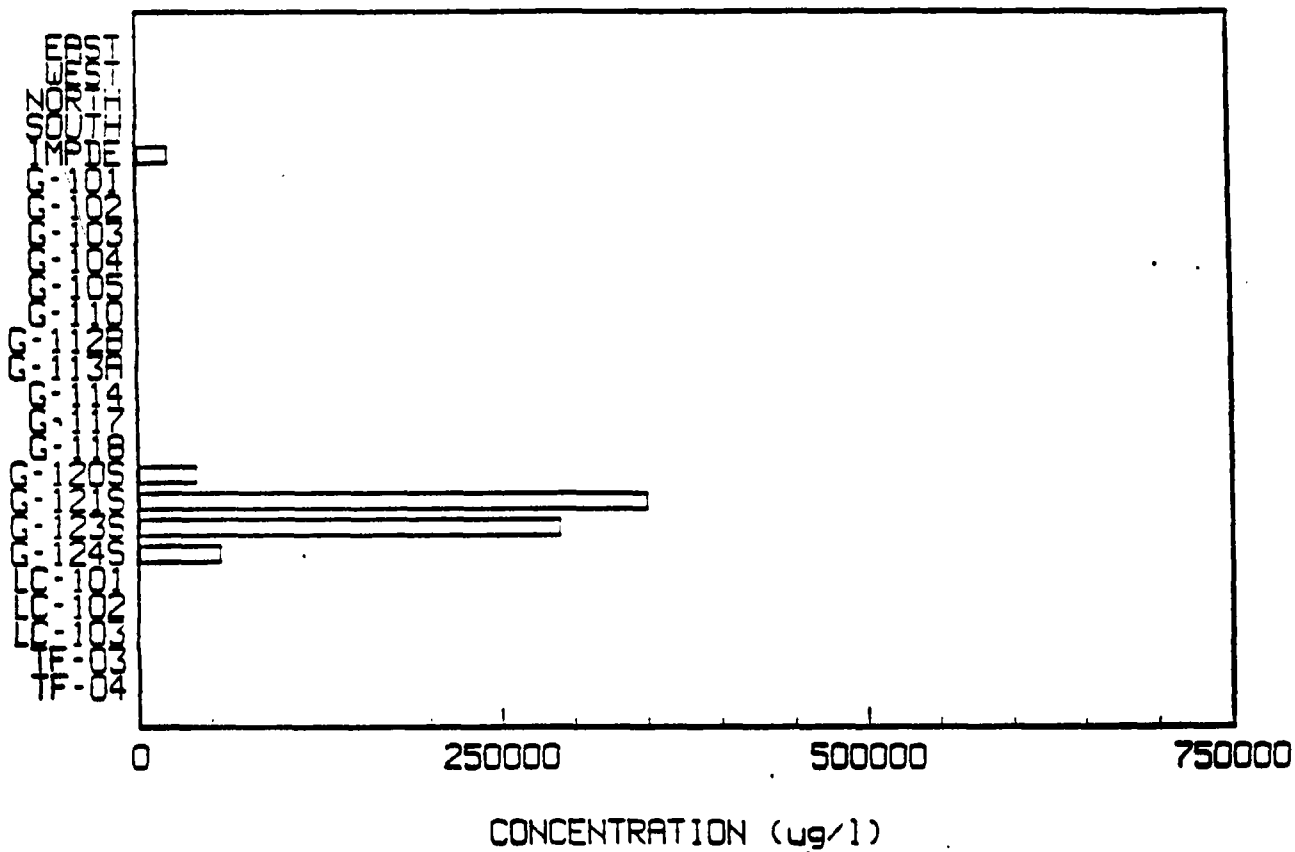








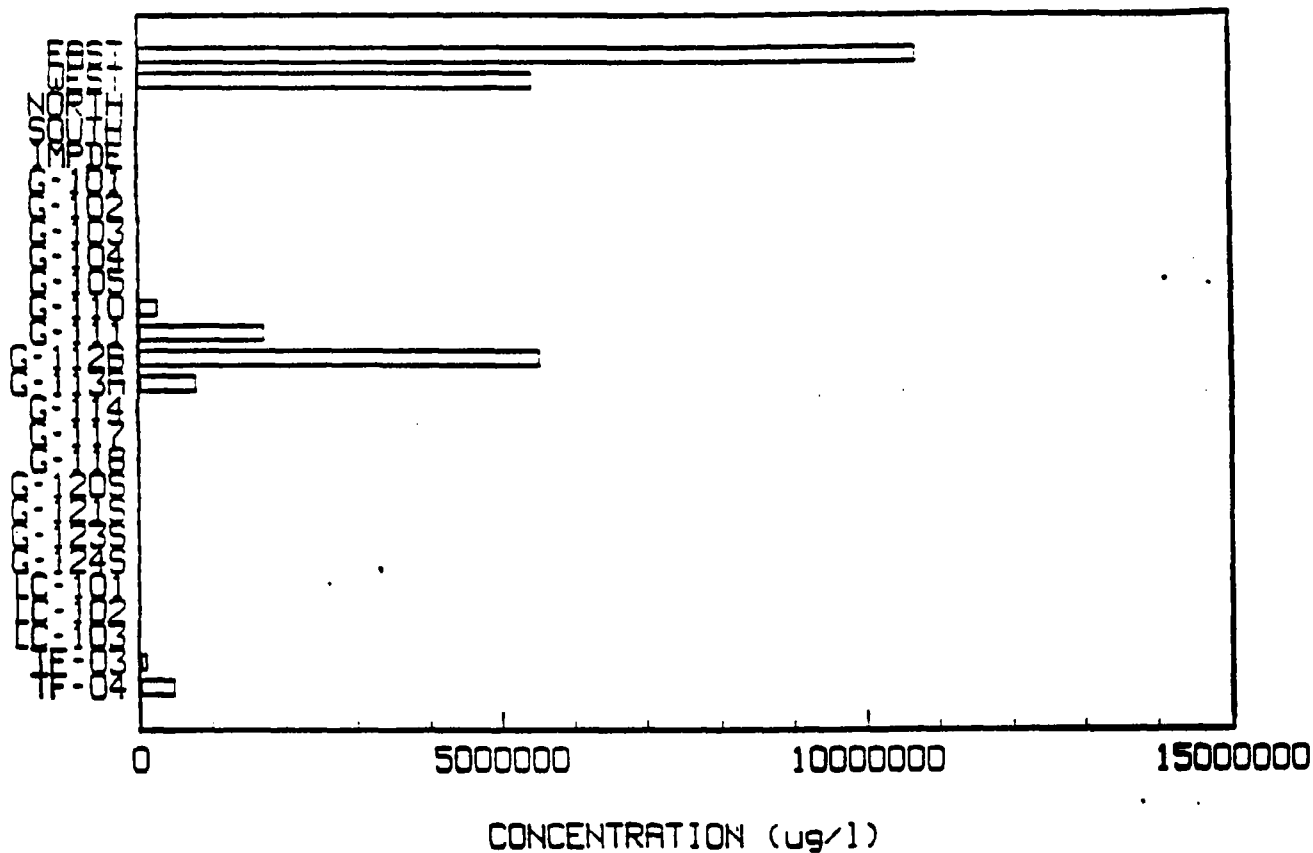
POTASSIUM, TOTAL  
04/30/87 - 05/01/87



NOTE: NO PRACTICAL METHOD DETECTION LIMIT CALCULATED

JOB NO.	873-2096	SCALE	N.T.S.	FINGERPRINTS of INORGANIC DATA CONCENTRATION vs. LOCATION
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG. NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 6-1

SODIUM  
02/21/85



NOTE: NO PRACTICAL METHOD DETECTION LIMIT CALCULATED

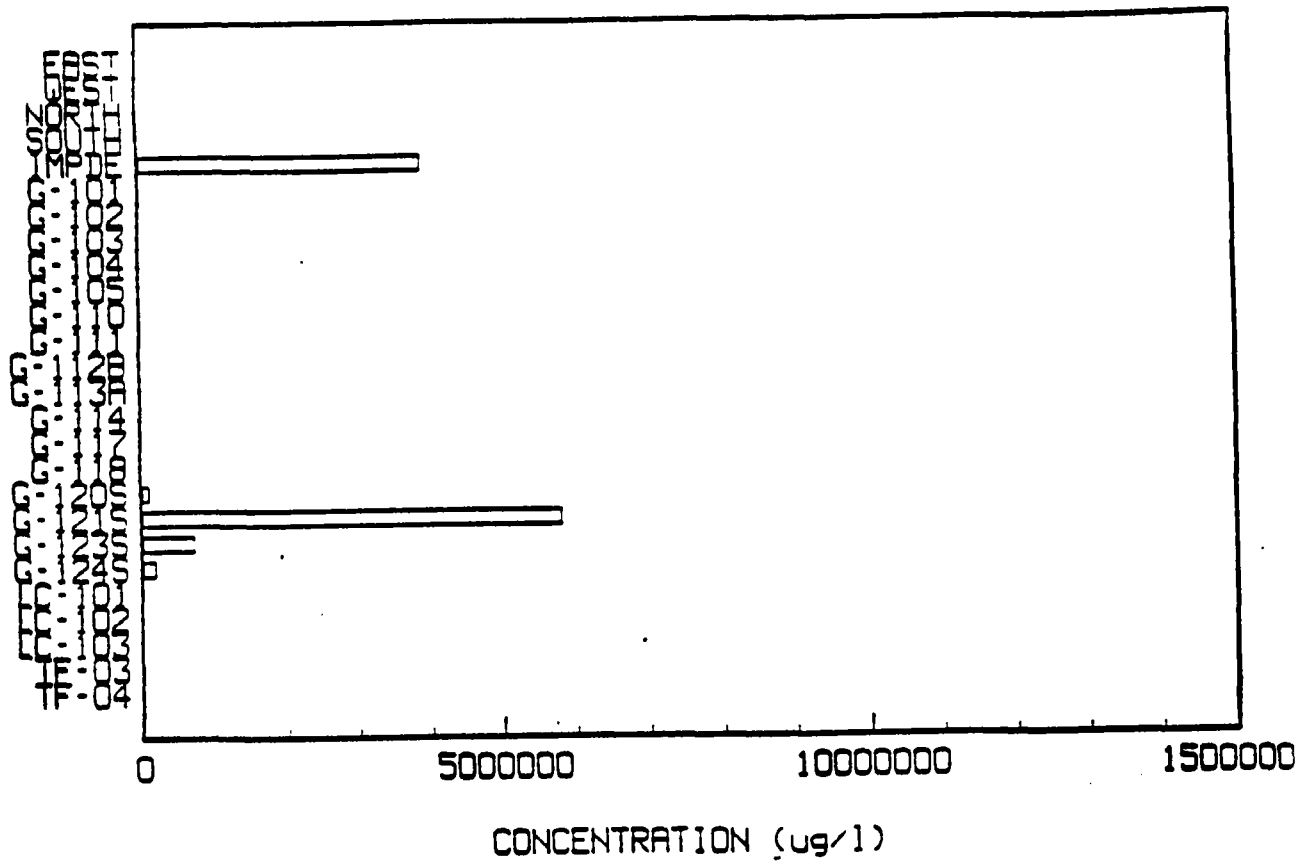
JOB NO.	873-2096	SCALE	N.T.S.	FINGERPRINTS of INORGANIC DATA CONCENTRATION vs. LOCATION
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWS NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 6-



[illegible]

JOB NO.	873-2096	SCALE	N.T.S.	FINGERPRINTS of INORGANIC DATA CONCENTRATION vs.LOCATION	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 6-2

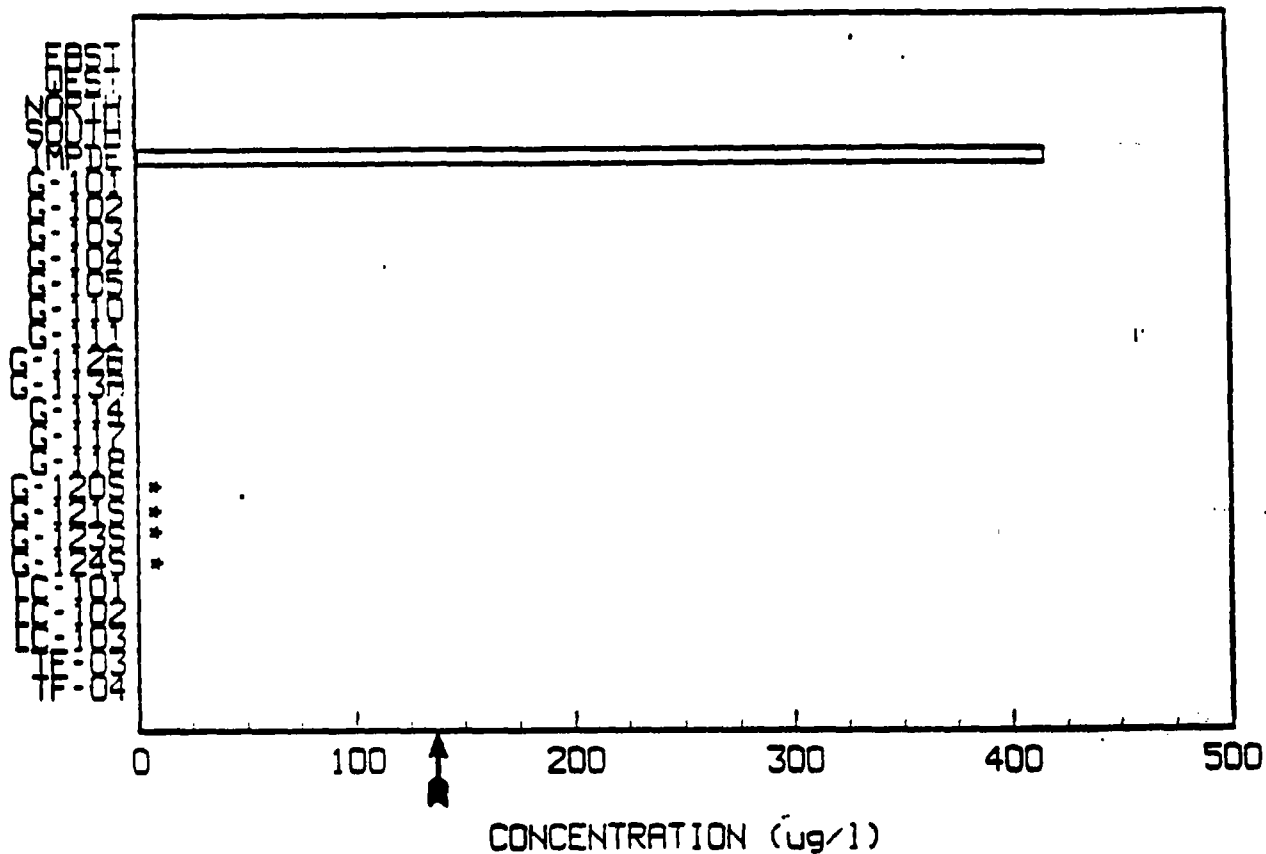
SODIUM, TOTAL  
04/30/87 - 05/01/87



NOTE: NO PRACTICAL METHOD DETECTION LIMIT CALCULATED

JOB NO.	873-2096	SCALE	N.T.S.	FINGERPRINTS of INORGANIC DATA CONCENTRATION vs.LOCATION
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG. NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 6-

ZINC, TOTAL  
04/30/87 - 05/01/87



# LEGEND

\* BELOW PRACTICAL METHOD DETECTION LIMIT

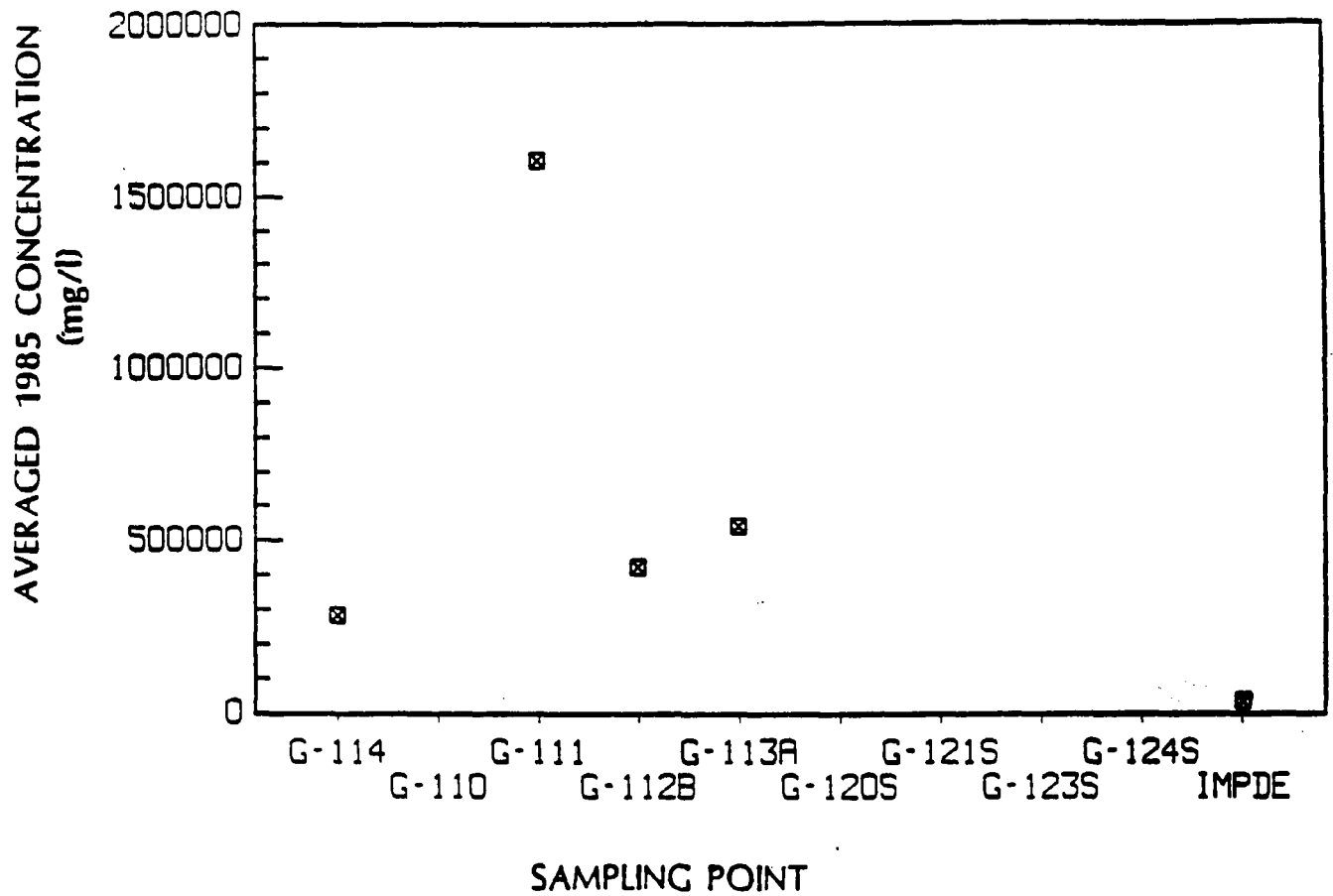
↑ PRACTICAL METHOD DETECTION LIMIT (PMDL)

JOB NO.	873-2096	SCALE	N.T.S.	FINGERPRINTS of INORGANIC DATA CONCENTRATION vs. LOCATION
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG. NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 6-22





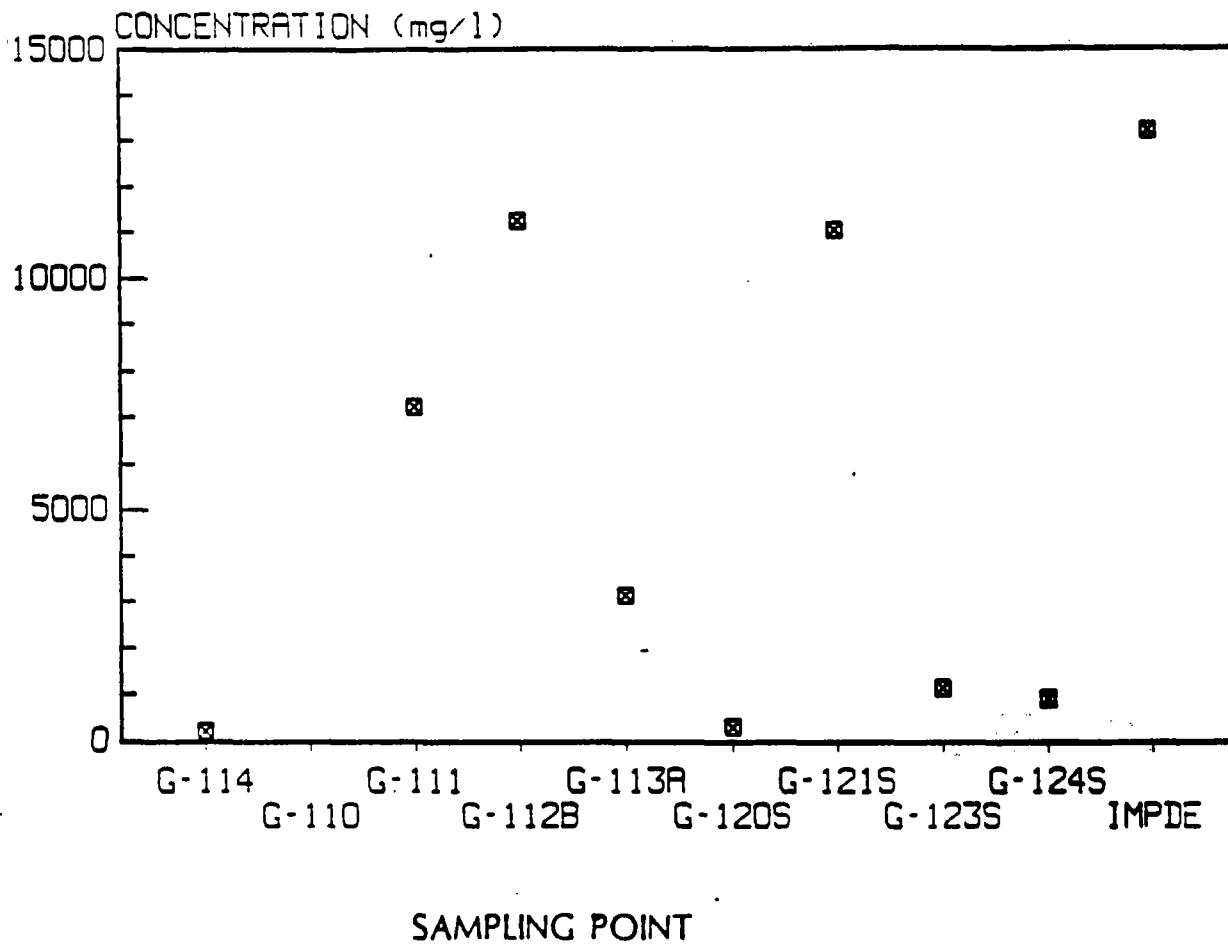
# CALCIUM



JOB NO.	873-2096	SCALE	N.T.S.	G-114 COMPARISON	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 8-

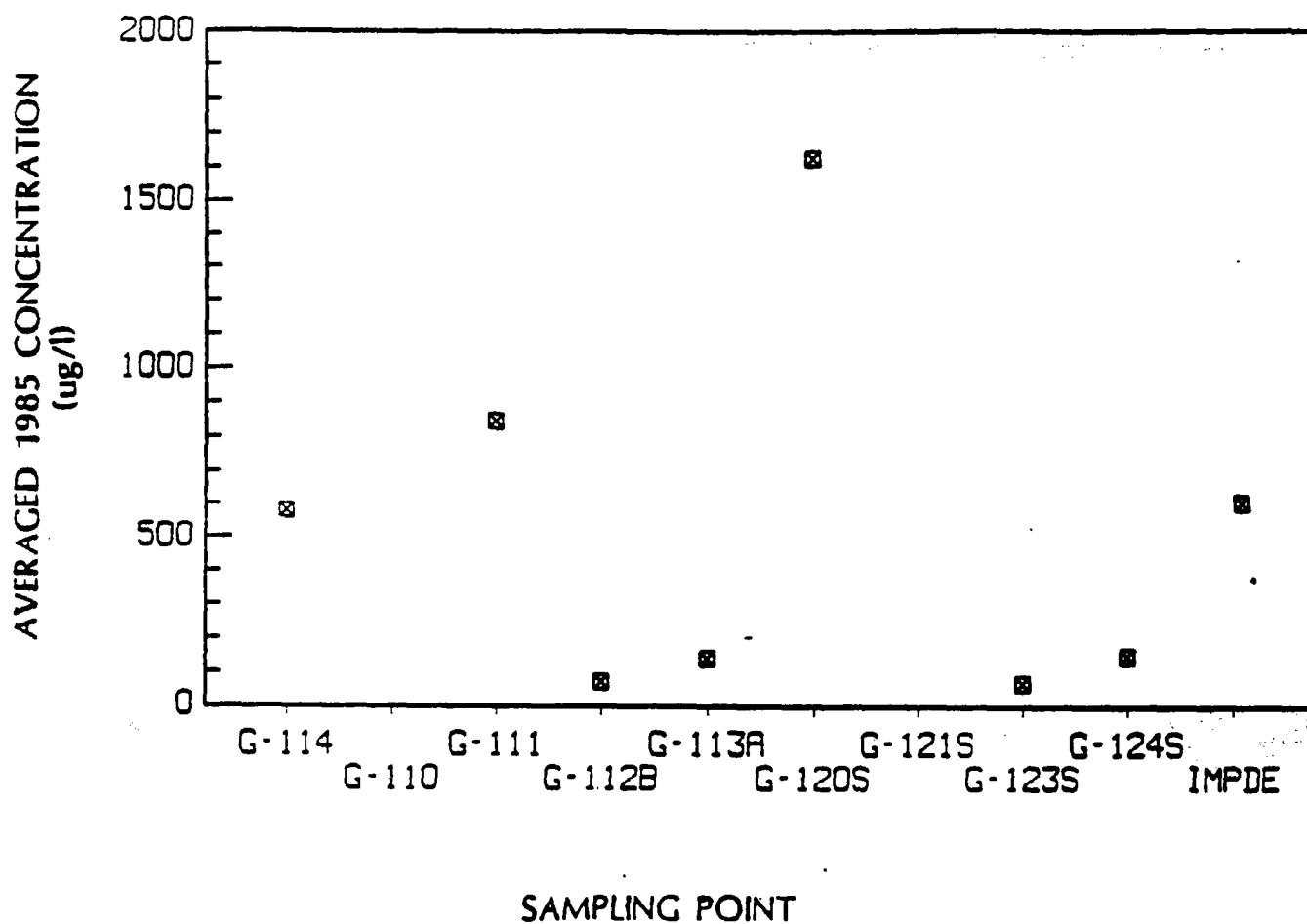
AVERAGED 1985 CONCENTRATION  
(mg/l)

# CHLORIDE



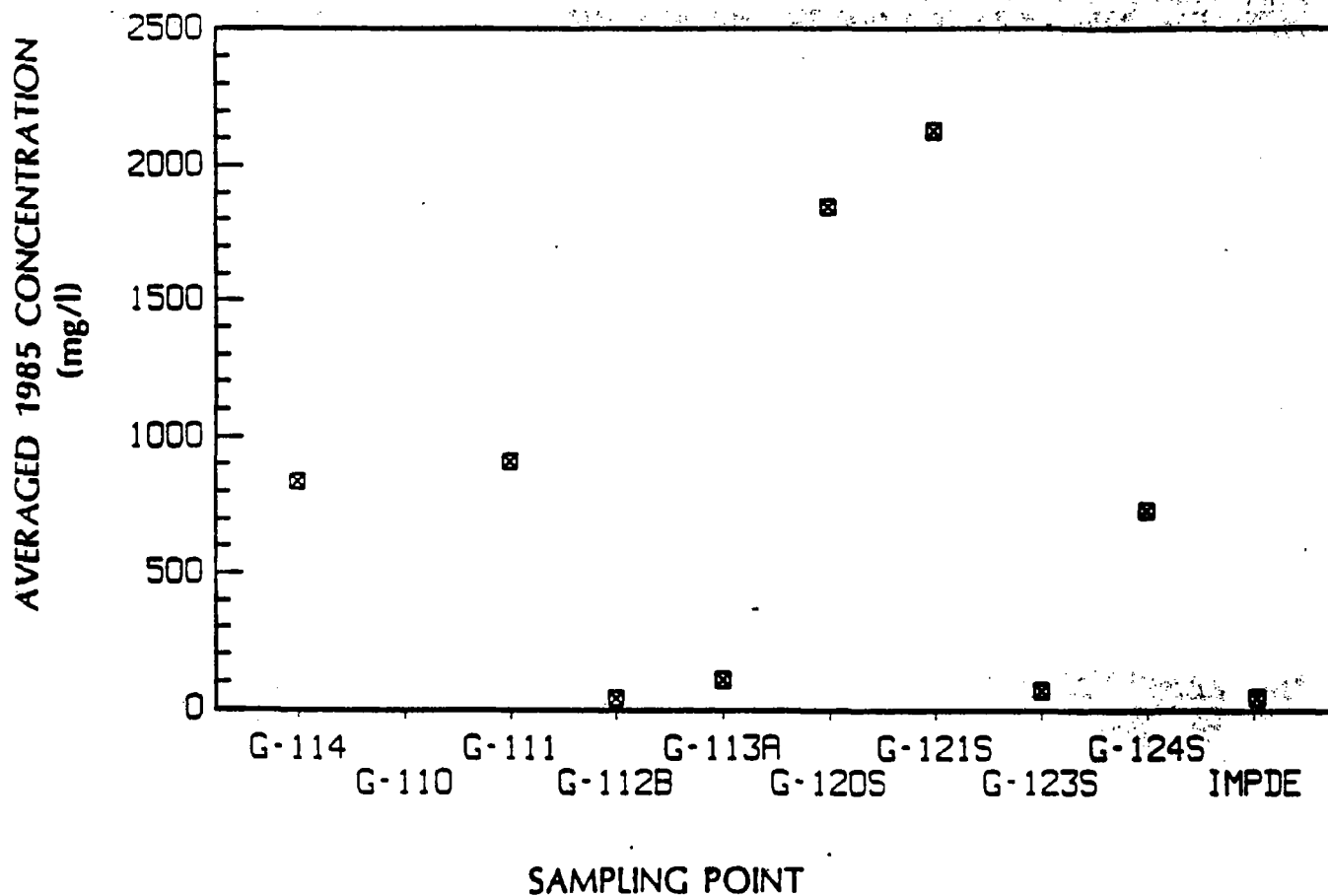
JOB NO.	873-2096	SCALE	N.T.S.	G-114 COMPARISON
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG. NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 8-2

# IRON



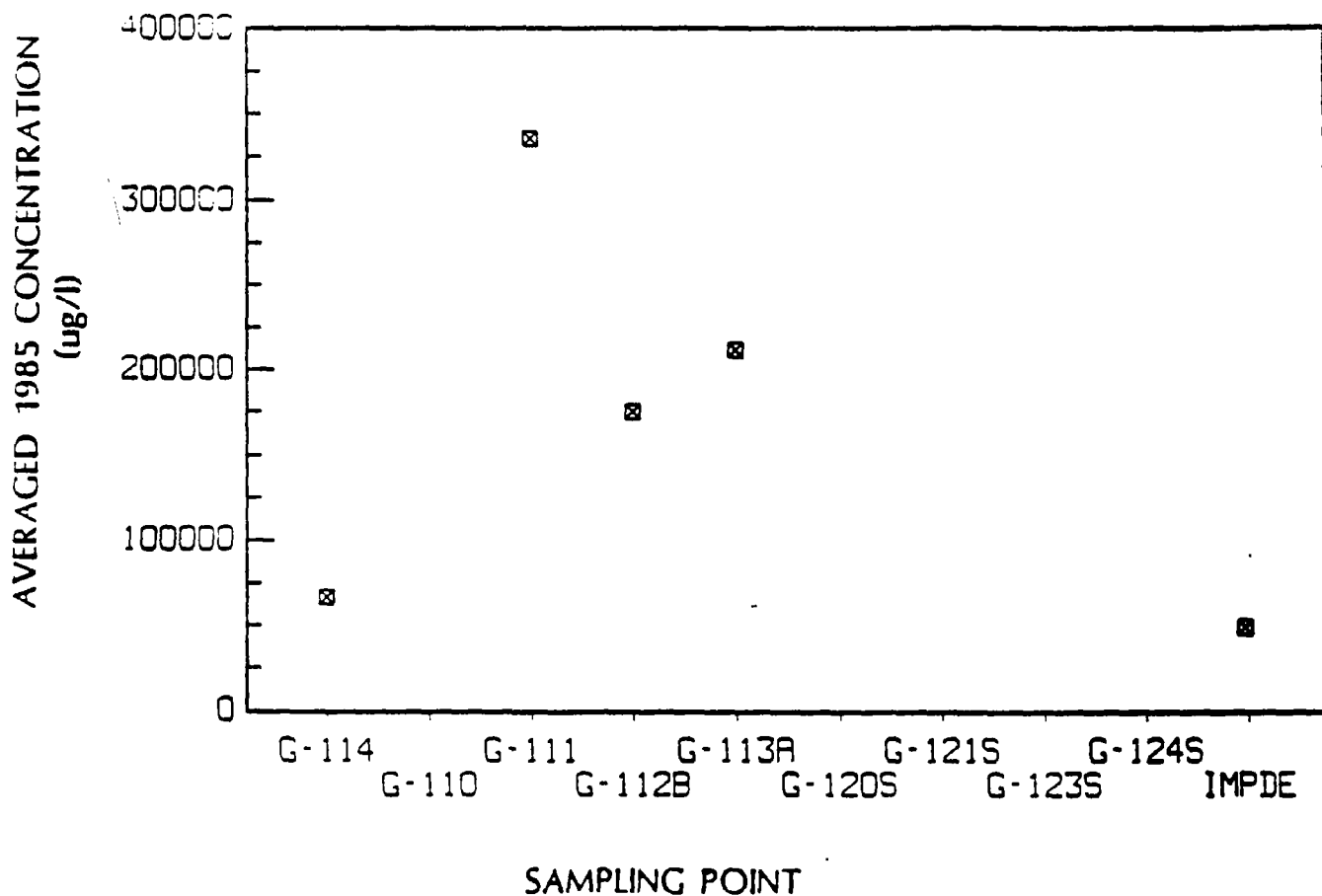
JOB NO.	873-2096	SCALE	N.T.S.	G-114 COMPARISON
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG. NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 8-3

# MANGANESE



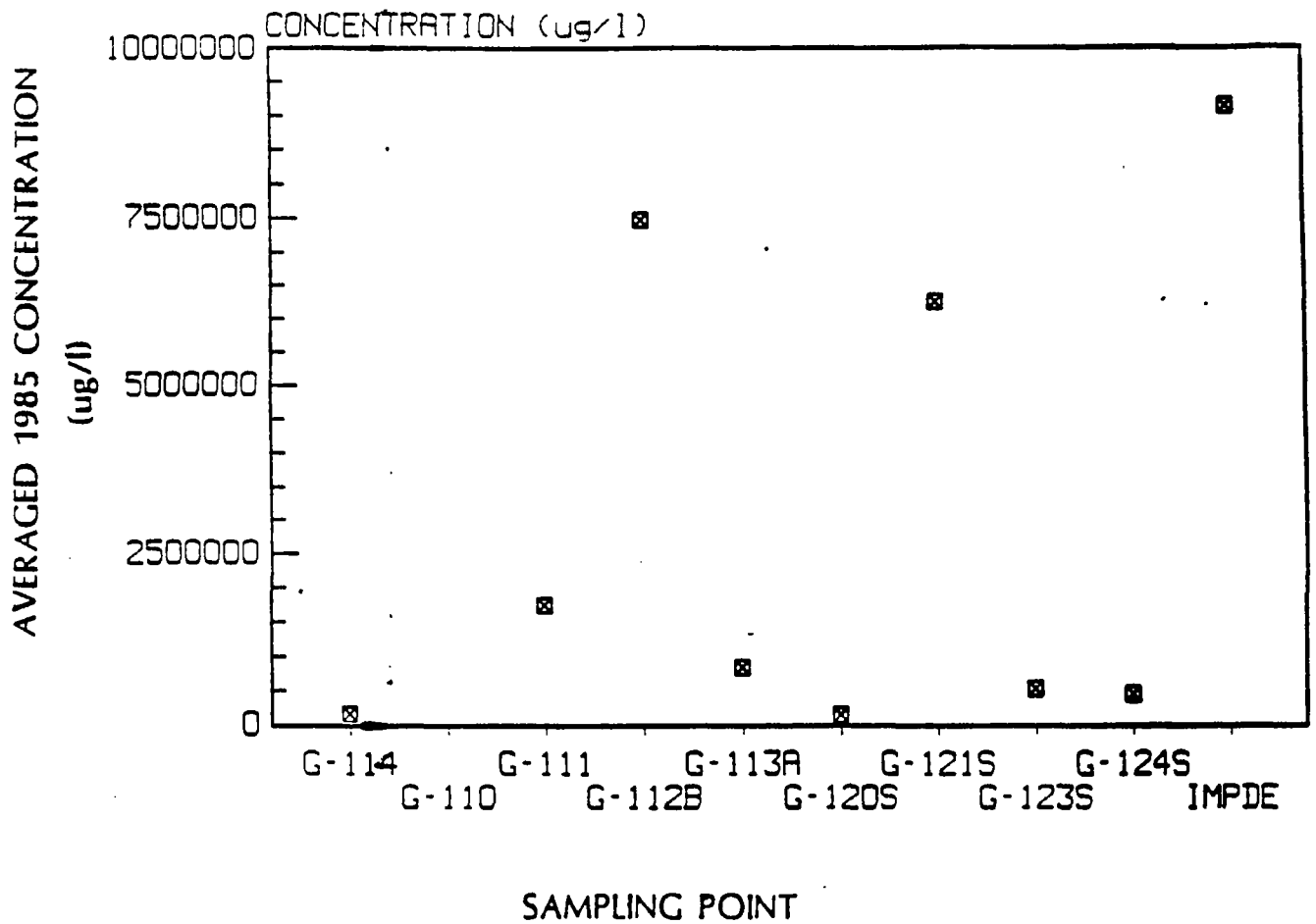
JOB NO.	873-2096	SCALE	N.T.S.	G-114 COMPARISON	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 8-2

# POTASSIUM



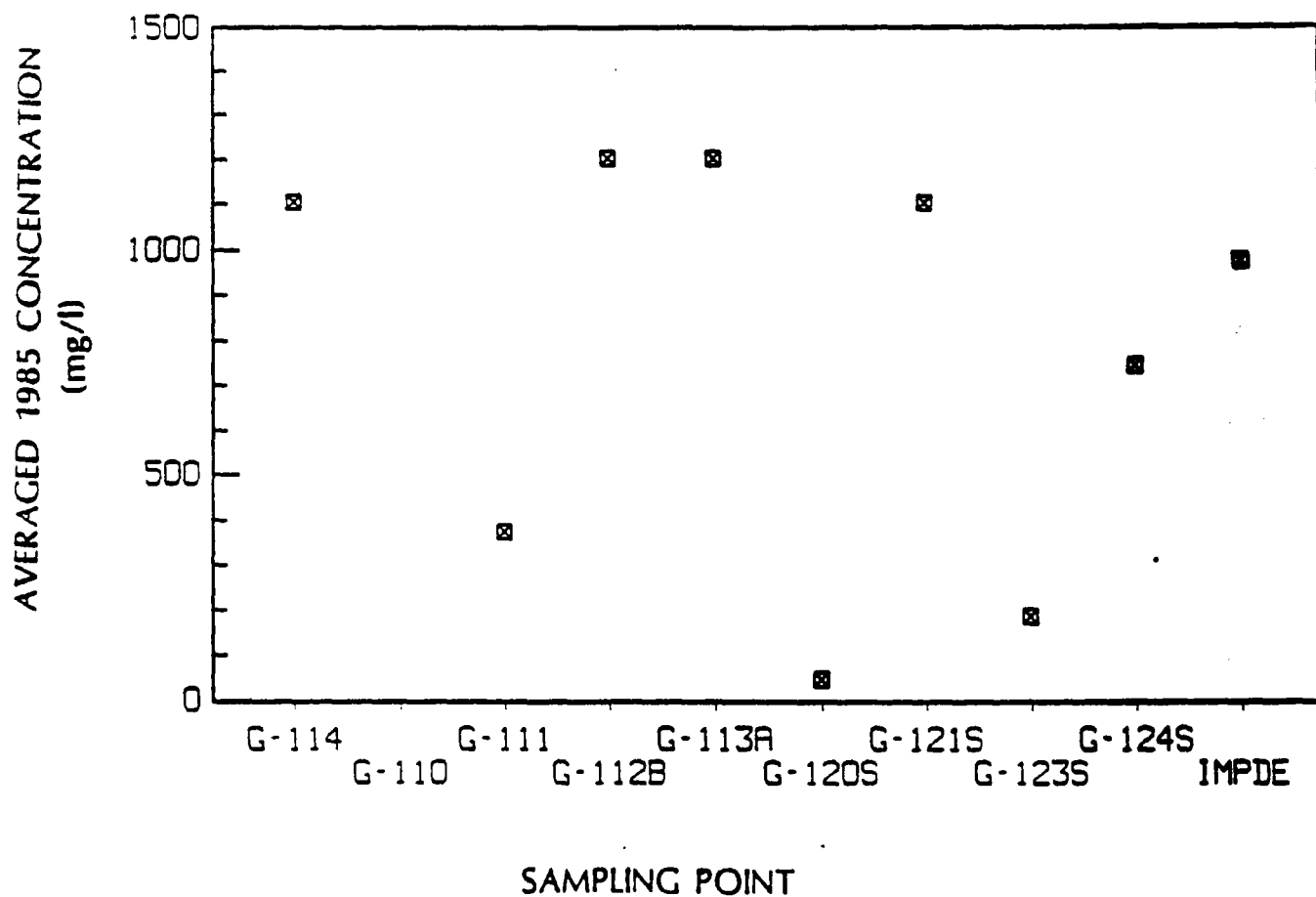
JOB NO.	873-2096	SCALE	N.T.S.	G-114 COMPARISON
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 8-5

# SODIUM



JOB NO.	873-2096	SCALE	N.T.S.	G-114 COMPARISON	FIGURE 8-6
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	

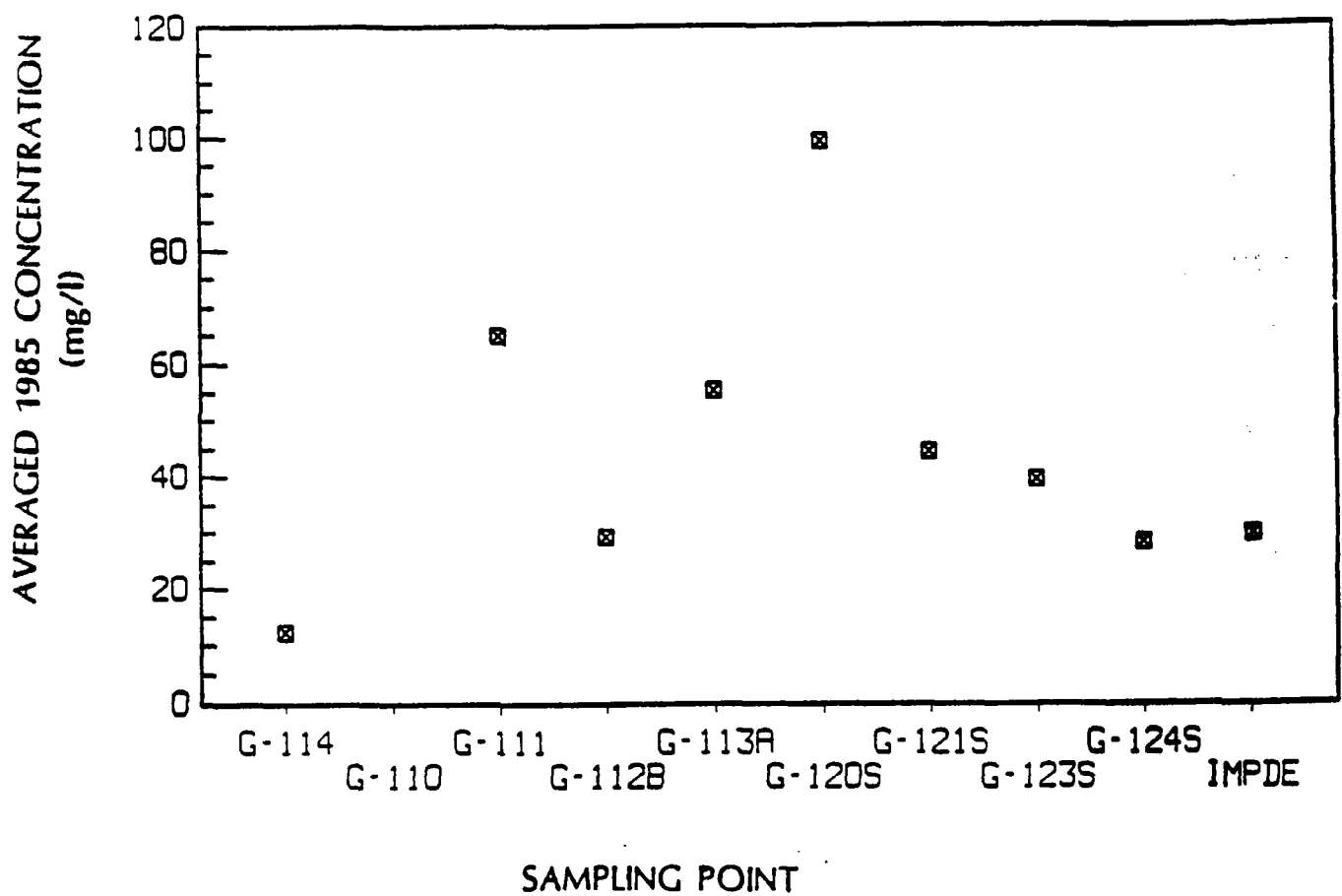
# SULFATE AS SO4



JOB NO.	873-2096	SCALE	N.T.S.	G-114 COMPARISON
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG. NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 8-

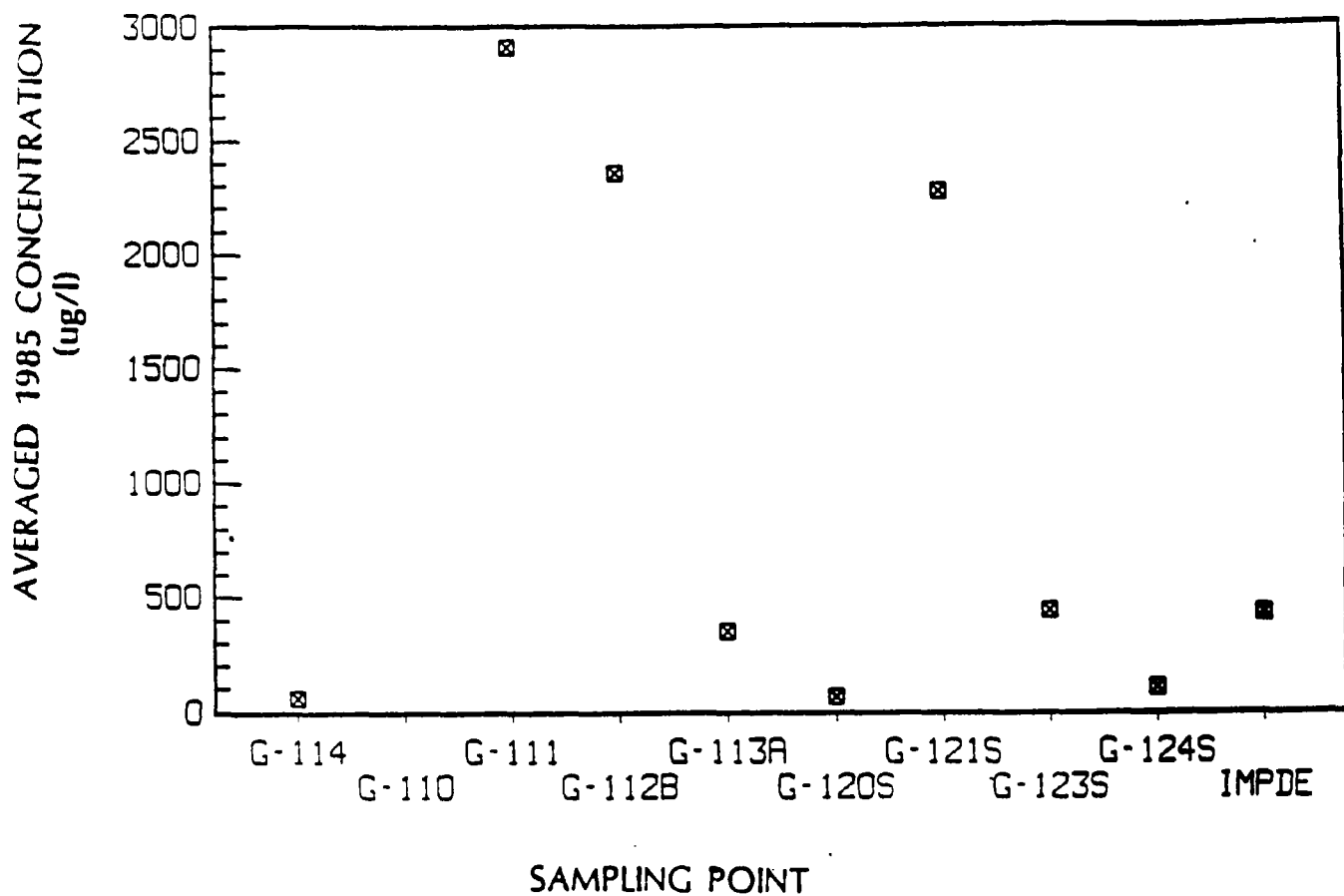


# TOTAL ORGANIC CARBON



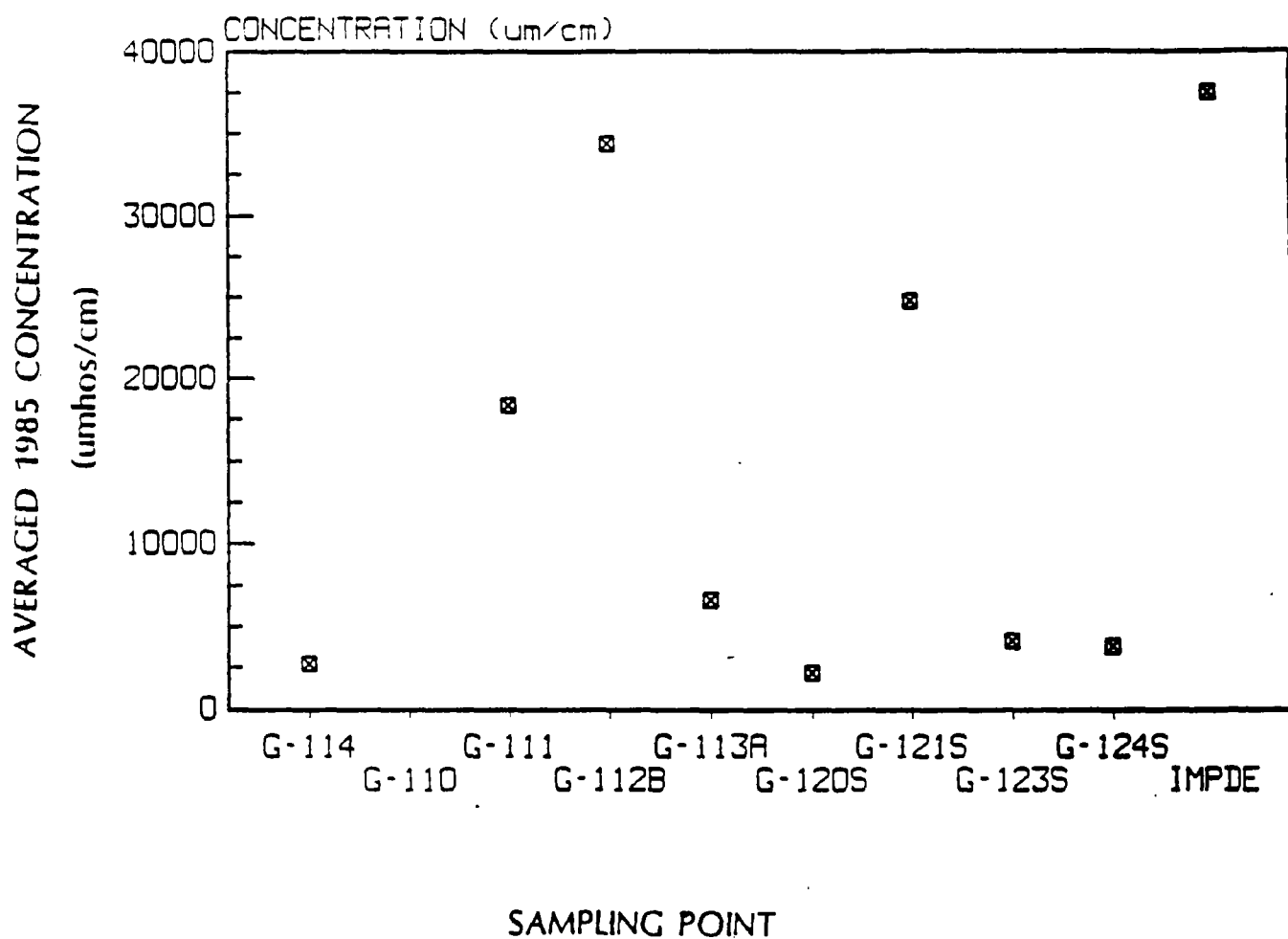
JOB NO.	873-2096	SCALE	N.T.S.	G-114 COMPARISON
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG. NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 8-E

TOX



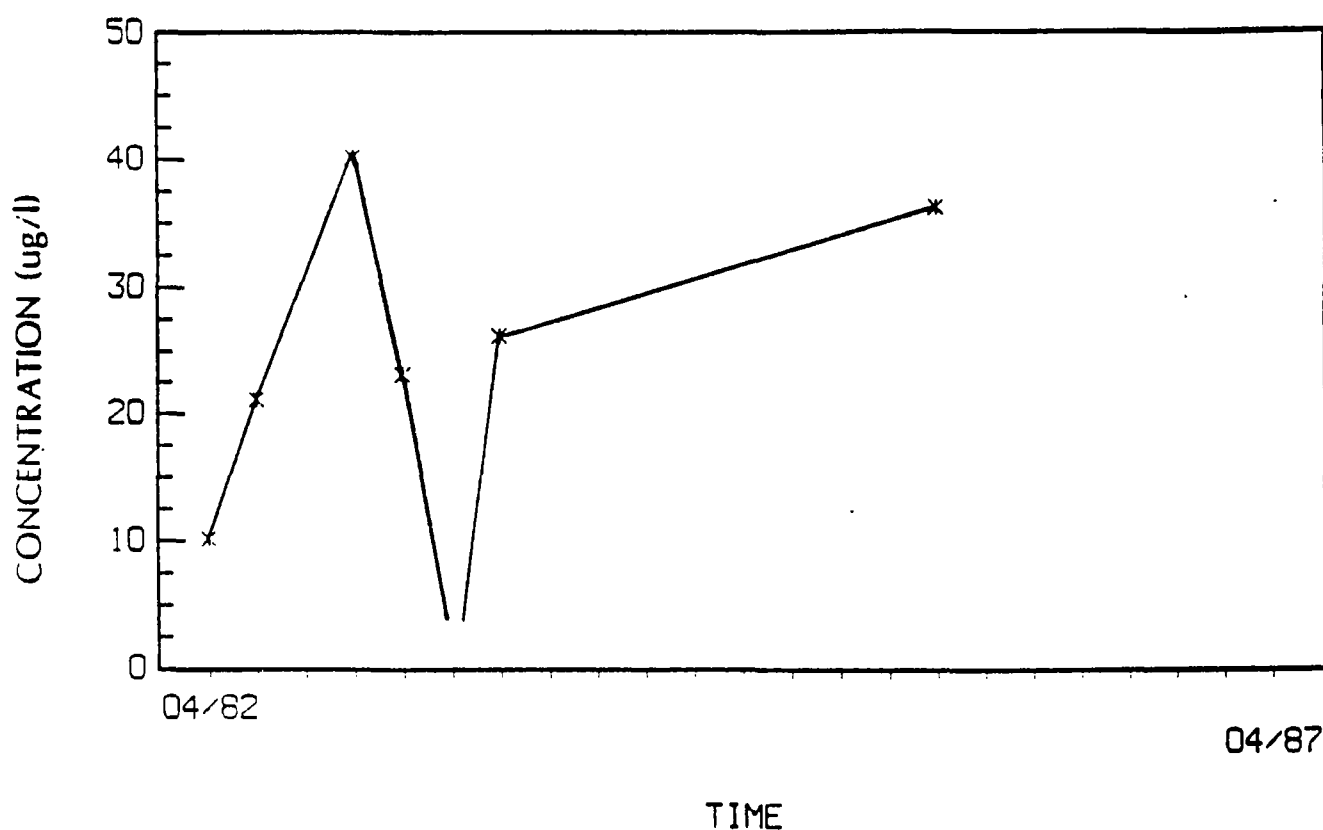
JOB NO.	873-2096	SCALE	N.T.S.	G-114 COMPARISON
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 8-9

# SPECIFIC CONDUCTANCE



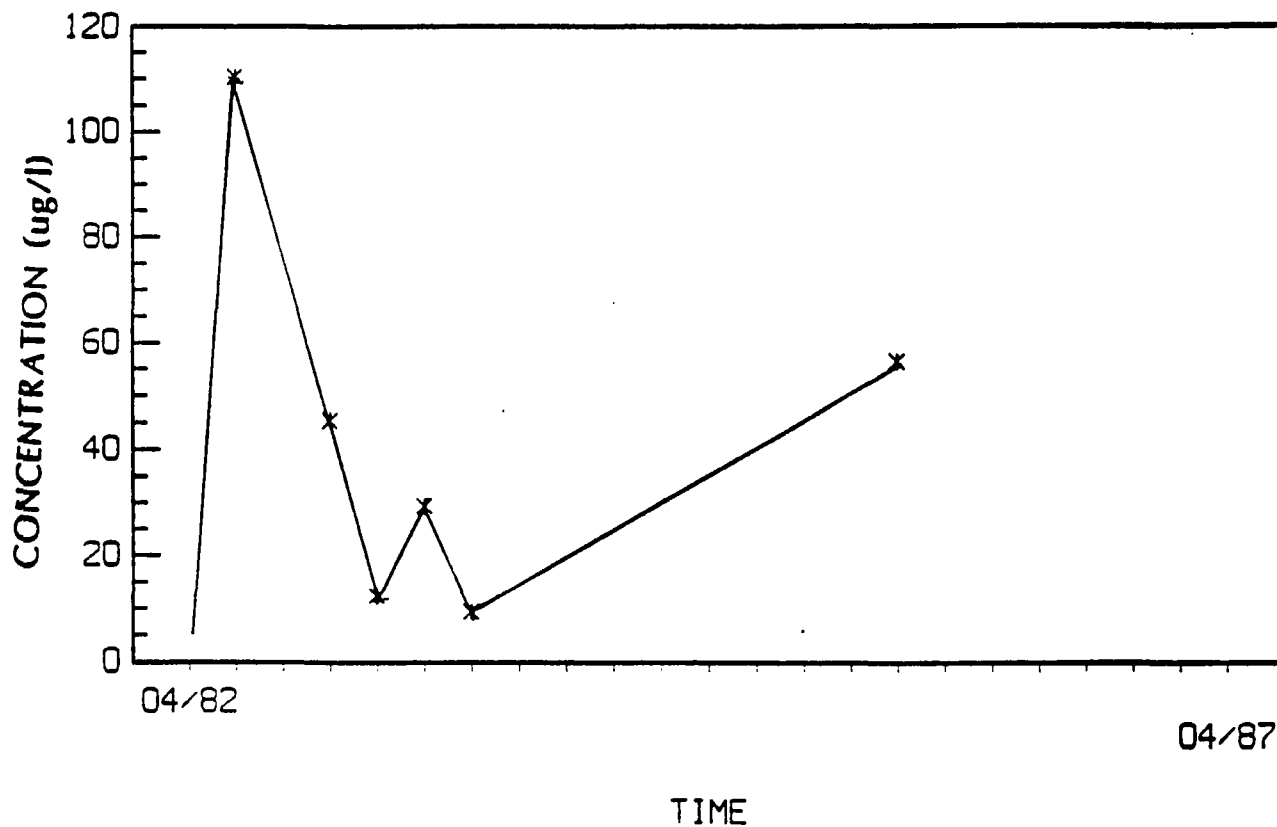
JOB NO.	873-2096	SCALE	N.T.S.	G-114 COMPARISON
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 8-1

# ARSENIC AT G-110



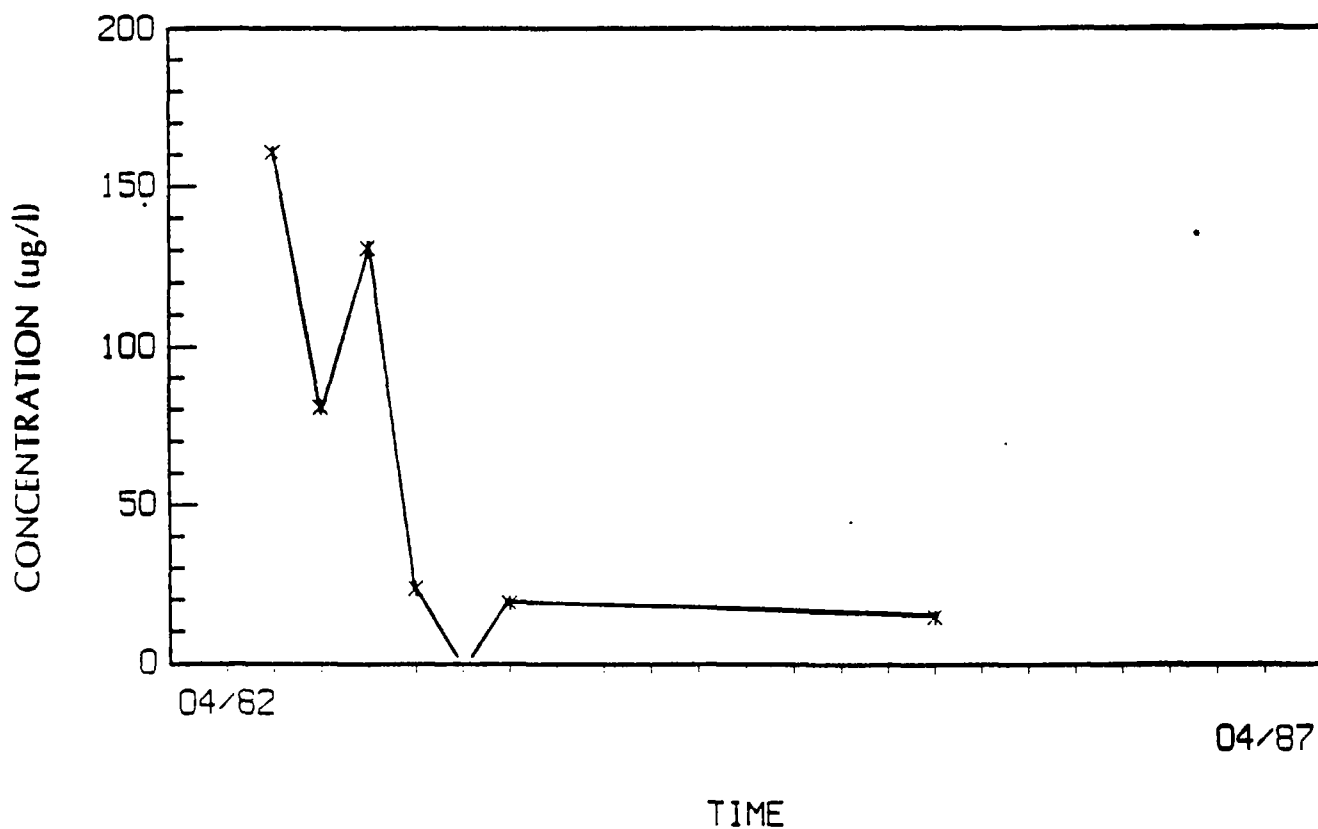
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-1

# ARSENIC AT G-111A



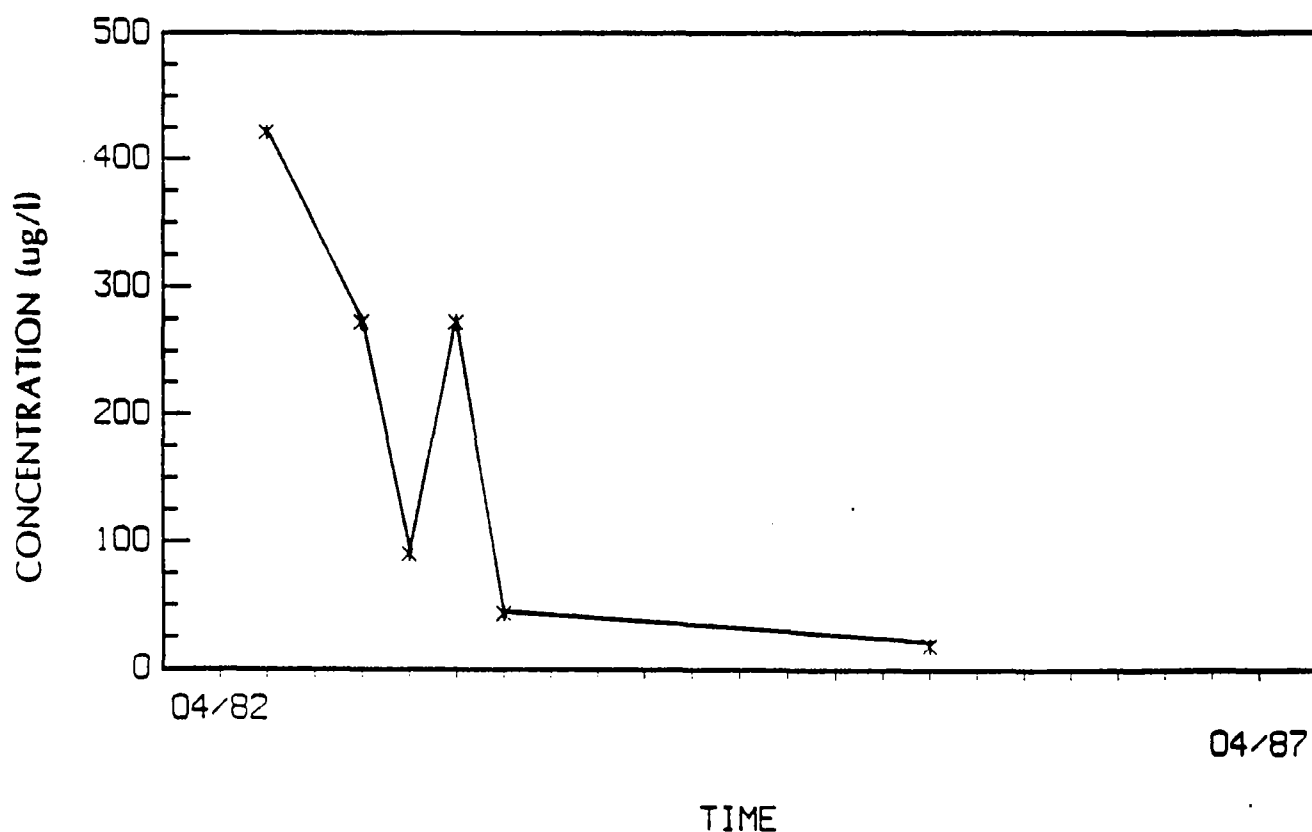
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG. NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 9-2

# ARSENIC AT G-112B



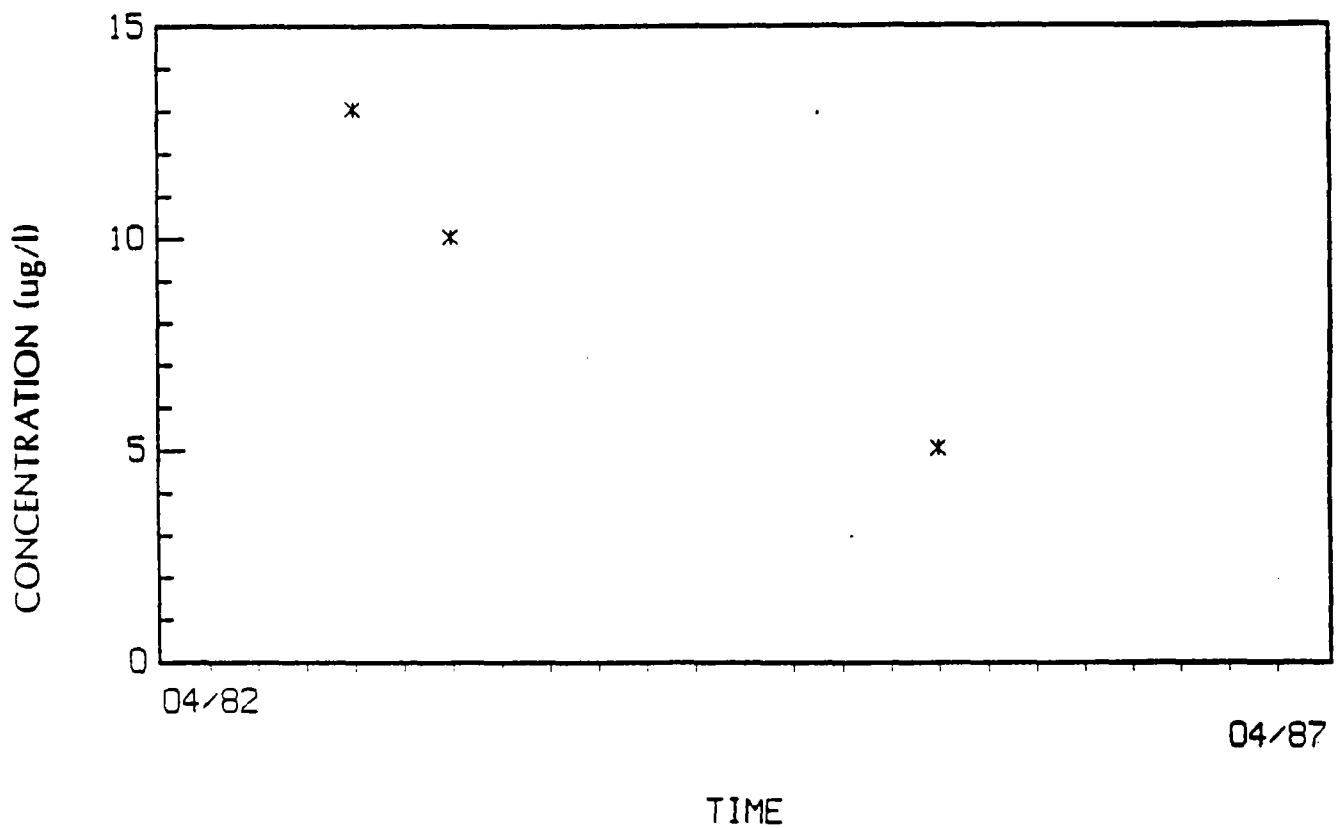
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG. NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 9-

# ARSENIC AT G-113A



JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-4

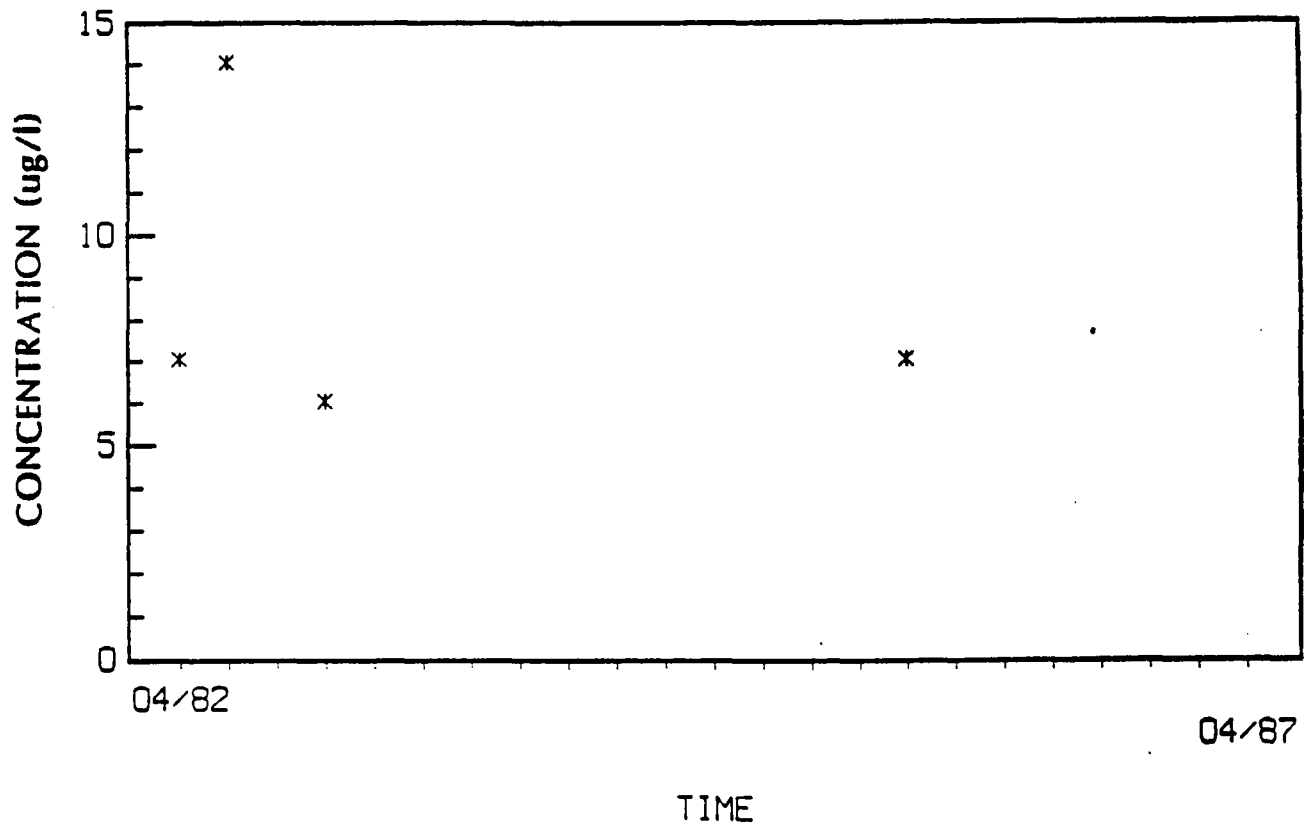
# CADMIUM AT G-110



JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-5

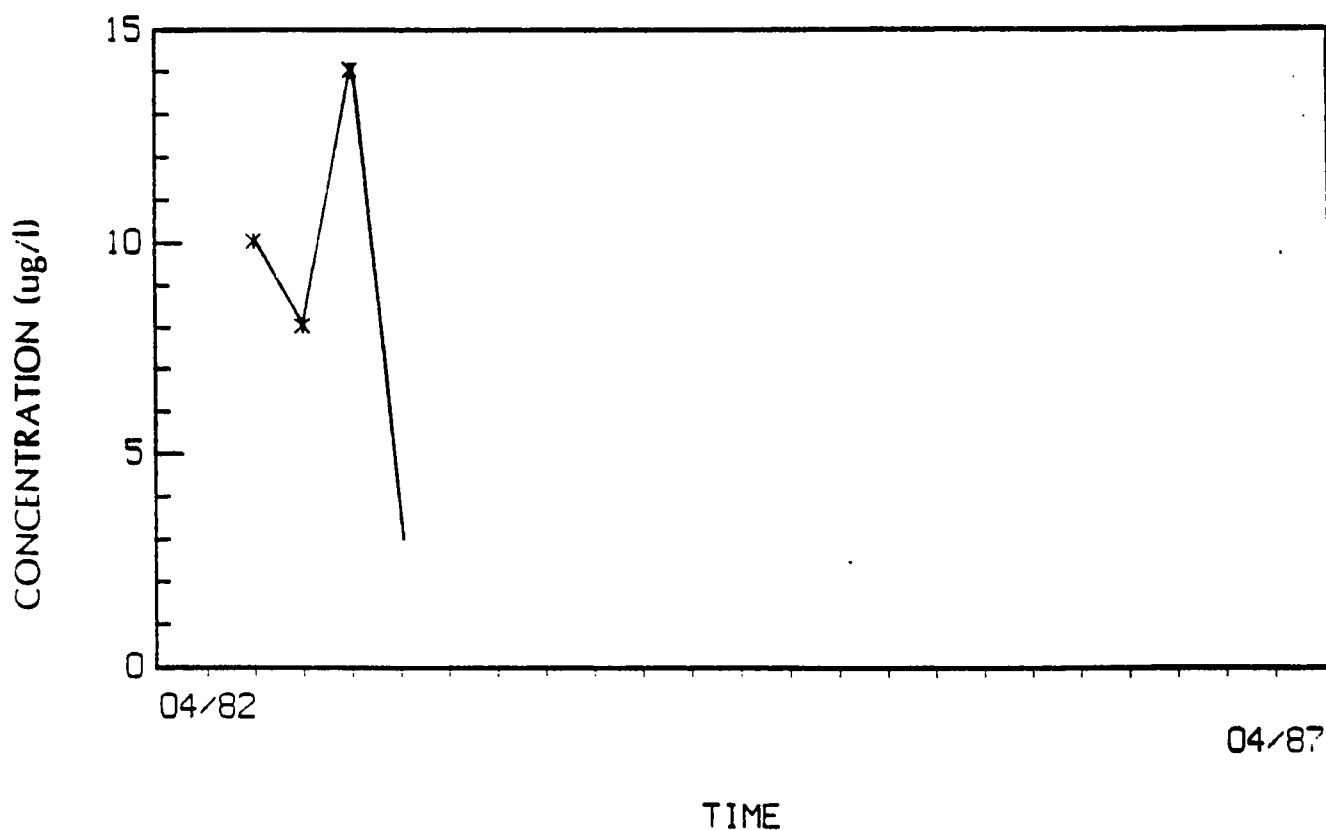


# CADMIUM AT G-111A



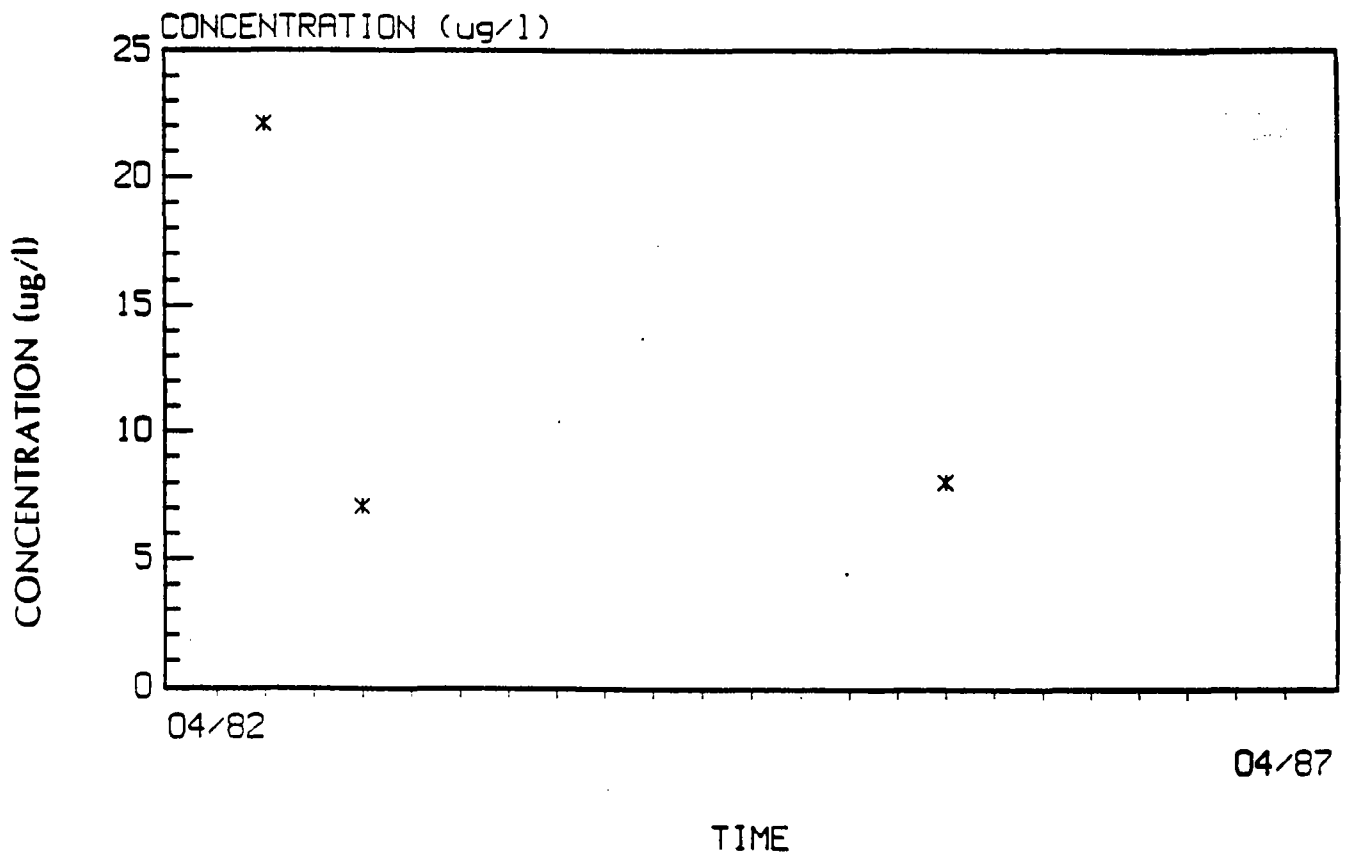
JOB NO.	873-2096	SCALE	N.T.S.	<p><b>TIME-TREND PLOTS</b>  <b>SCA CHICAGO INCINERATOR</b></p>	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
<p><b>Golder Associates</b></p>				<p>CHEMICAL WASTE MANAGEMENT, INC.</p>	<p>FIGURE 9-6</p>

# CADMIUM AT G-112B



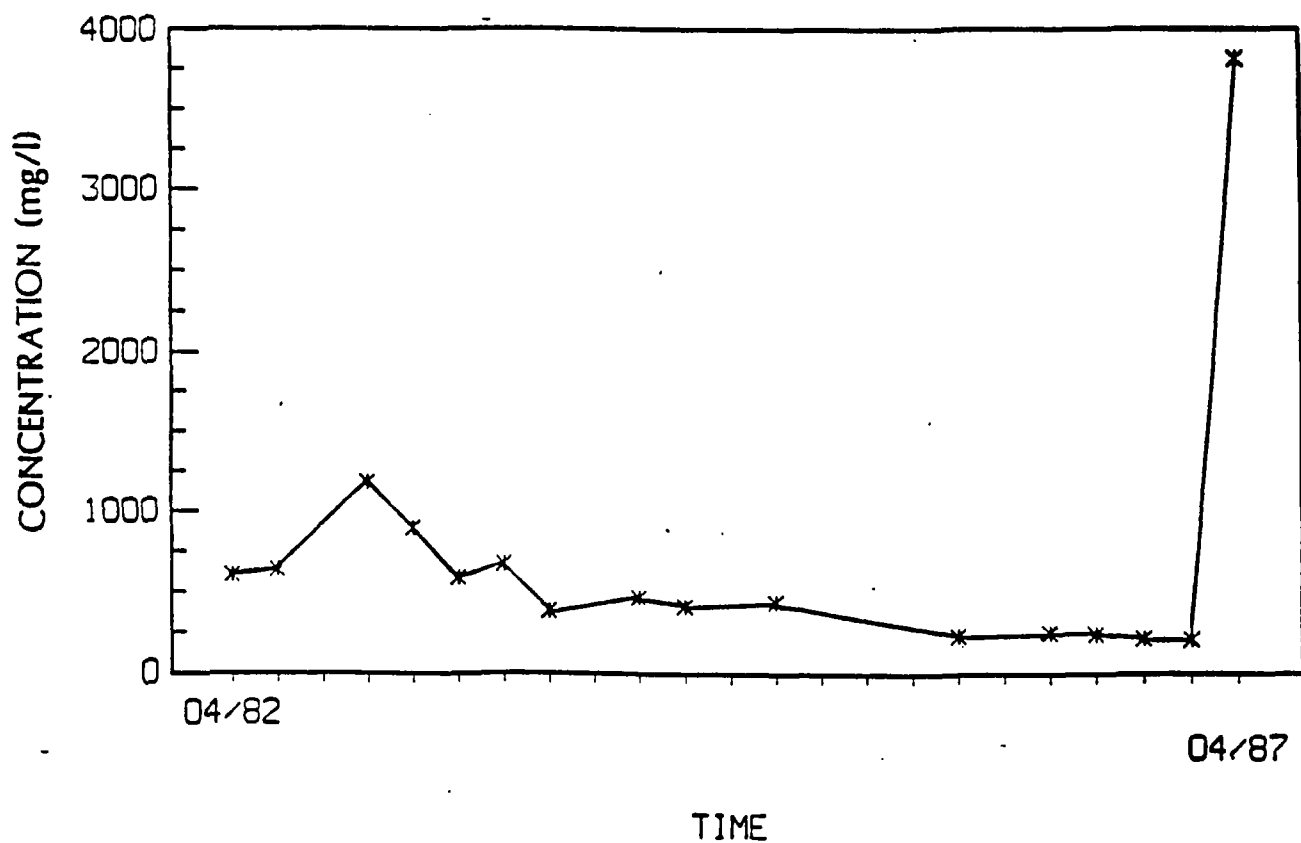
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-7

# CADMIUM AT G-113A



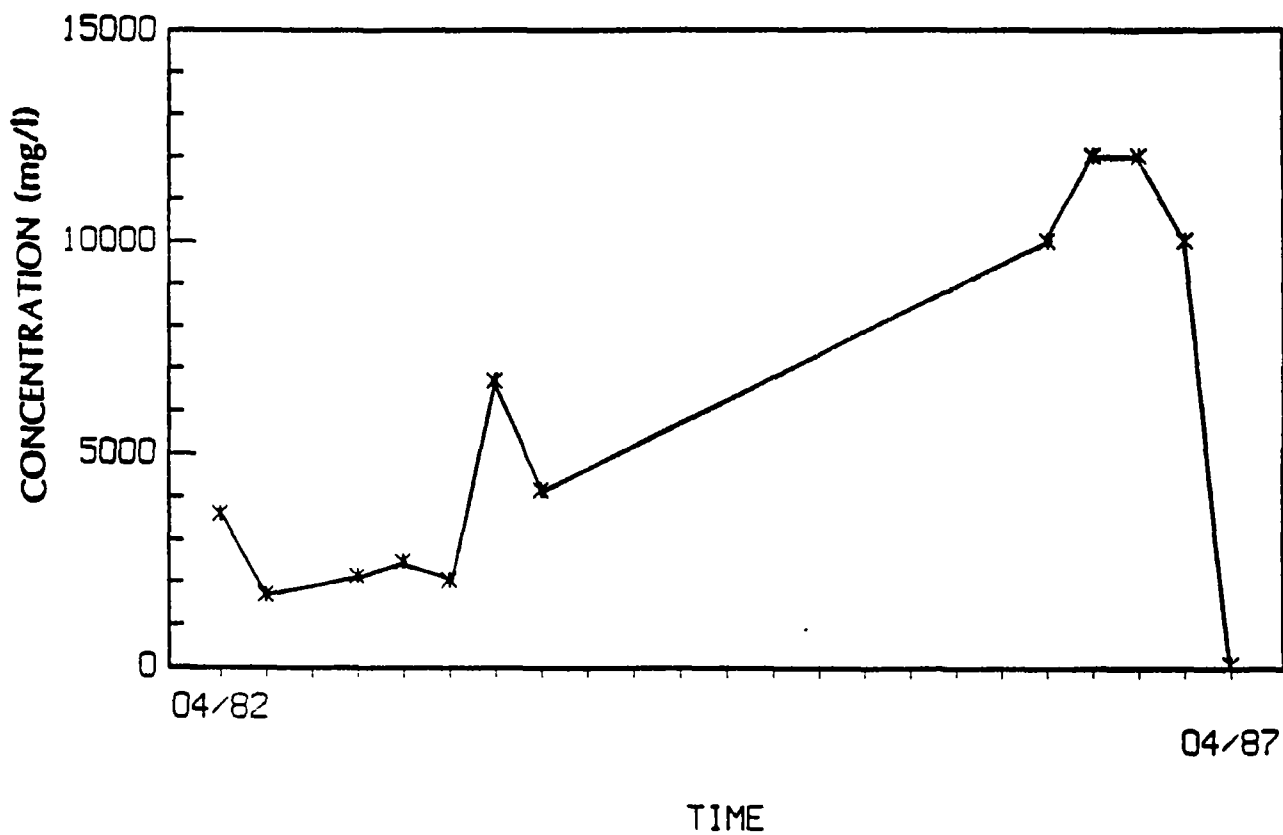
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-8

# CHLORIDE AT G-110



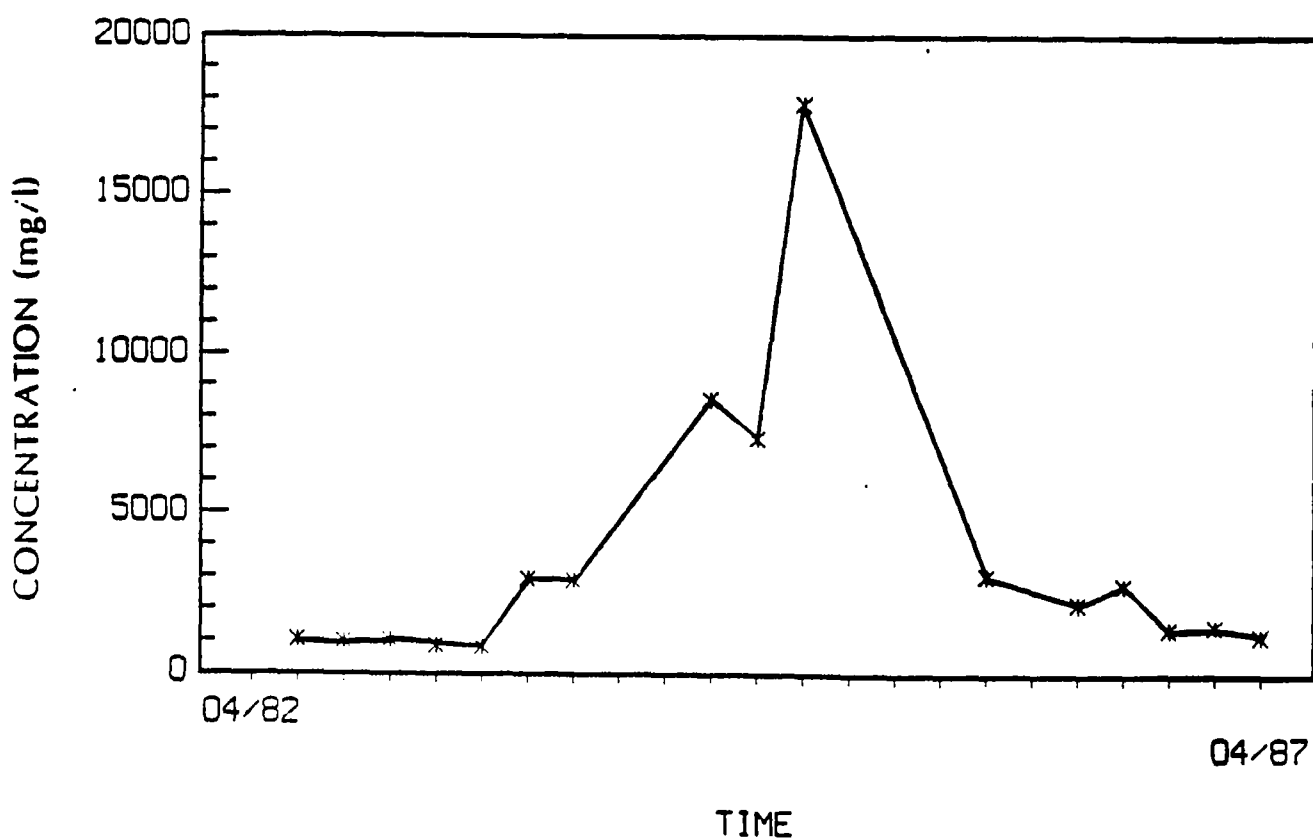
NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-9

# CHLORIDE AT G-111A



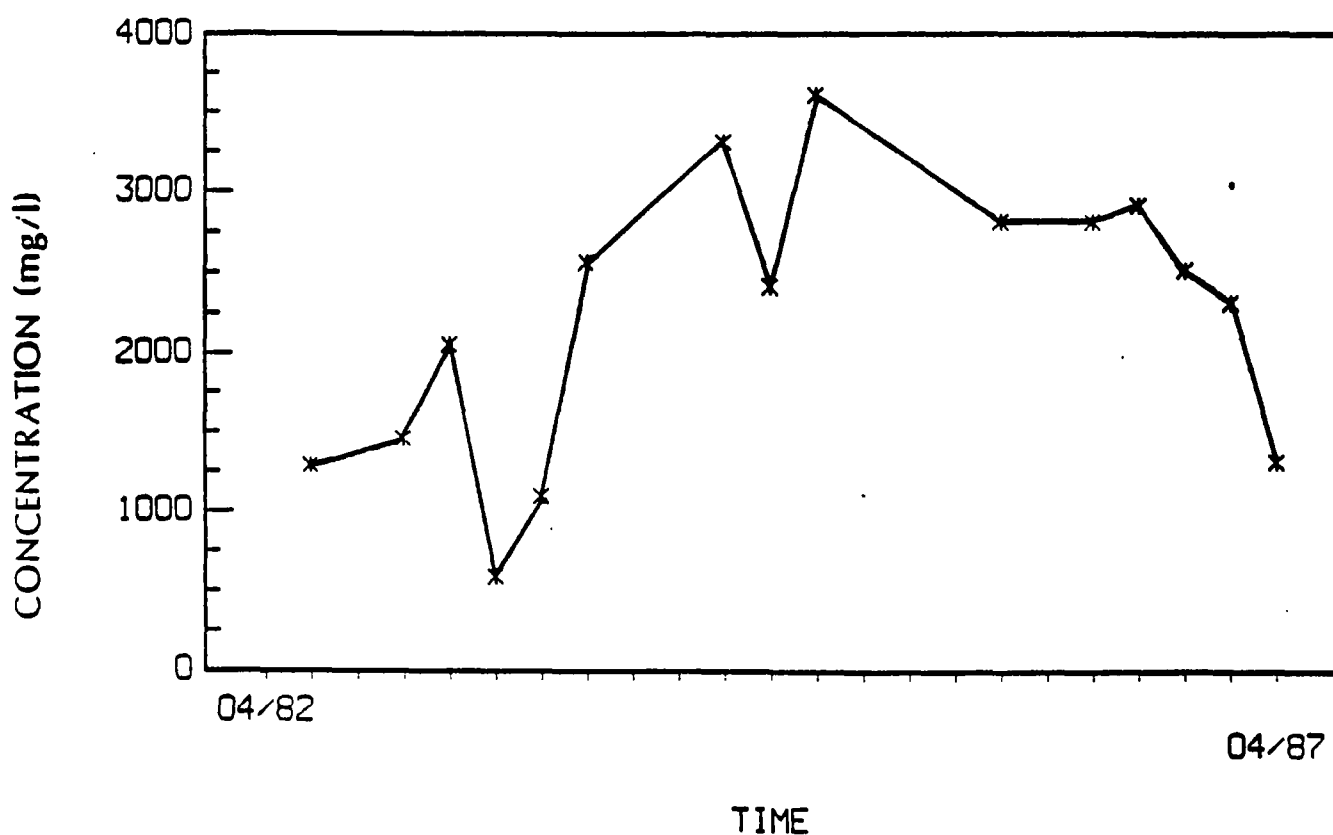
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-1C

# CHLORIDE AT G-112B



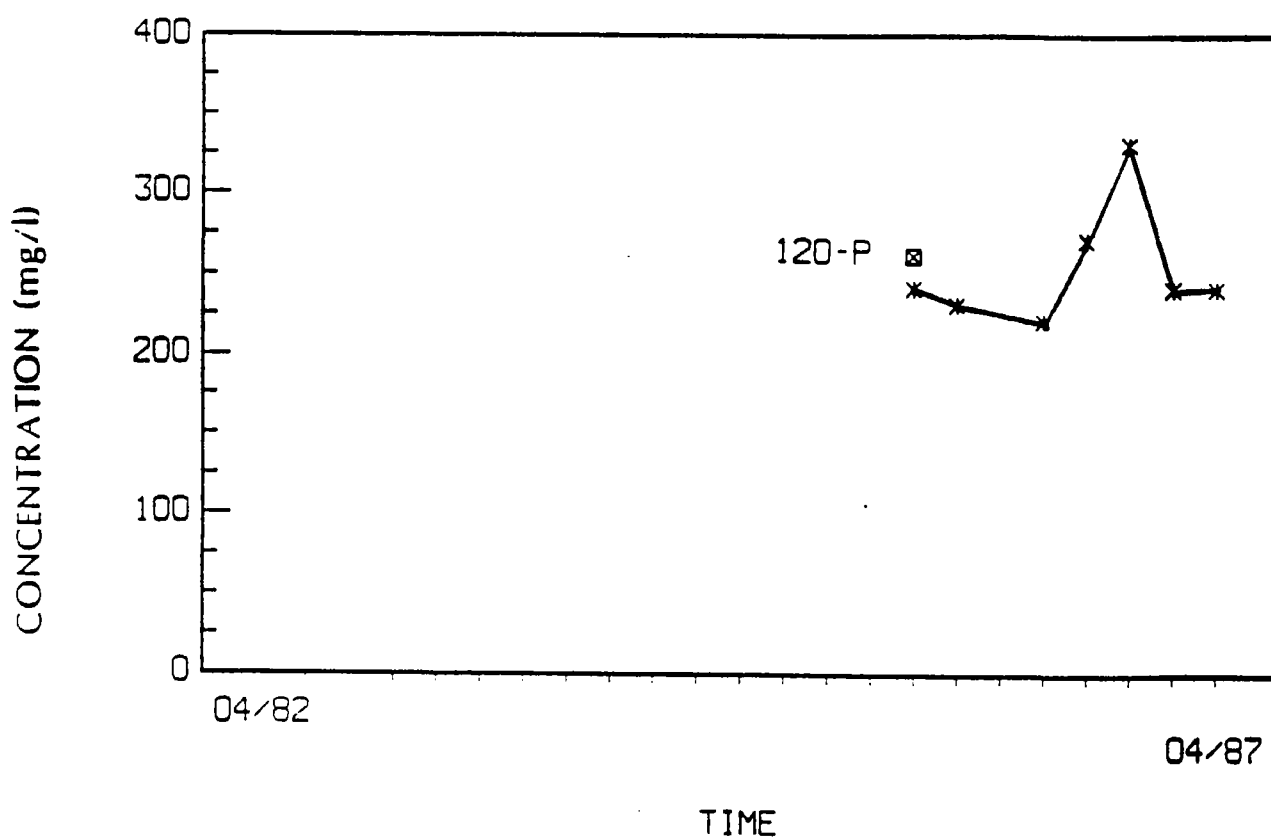
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-11

# CHLORIDE AT G-113A



JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-12

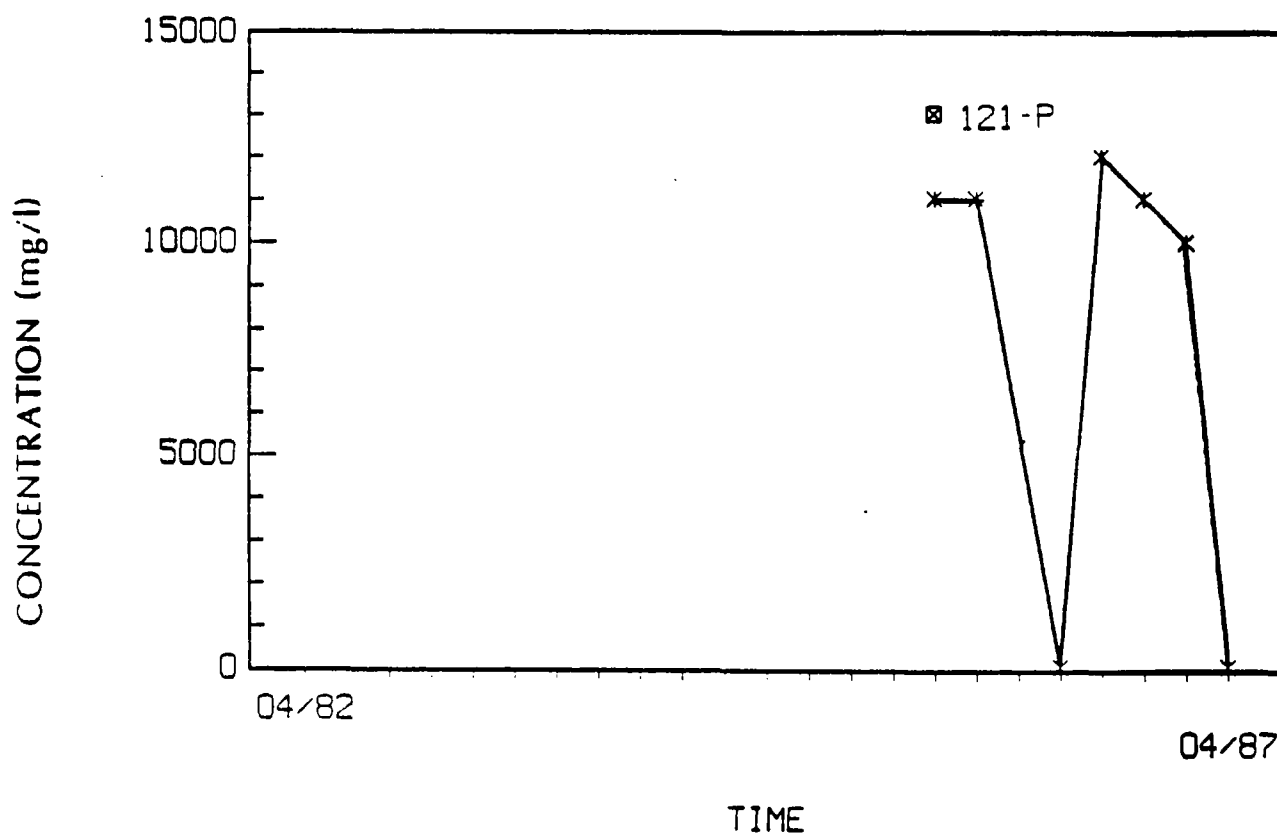
# CHLORIDE AT G-120S



JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-13

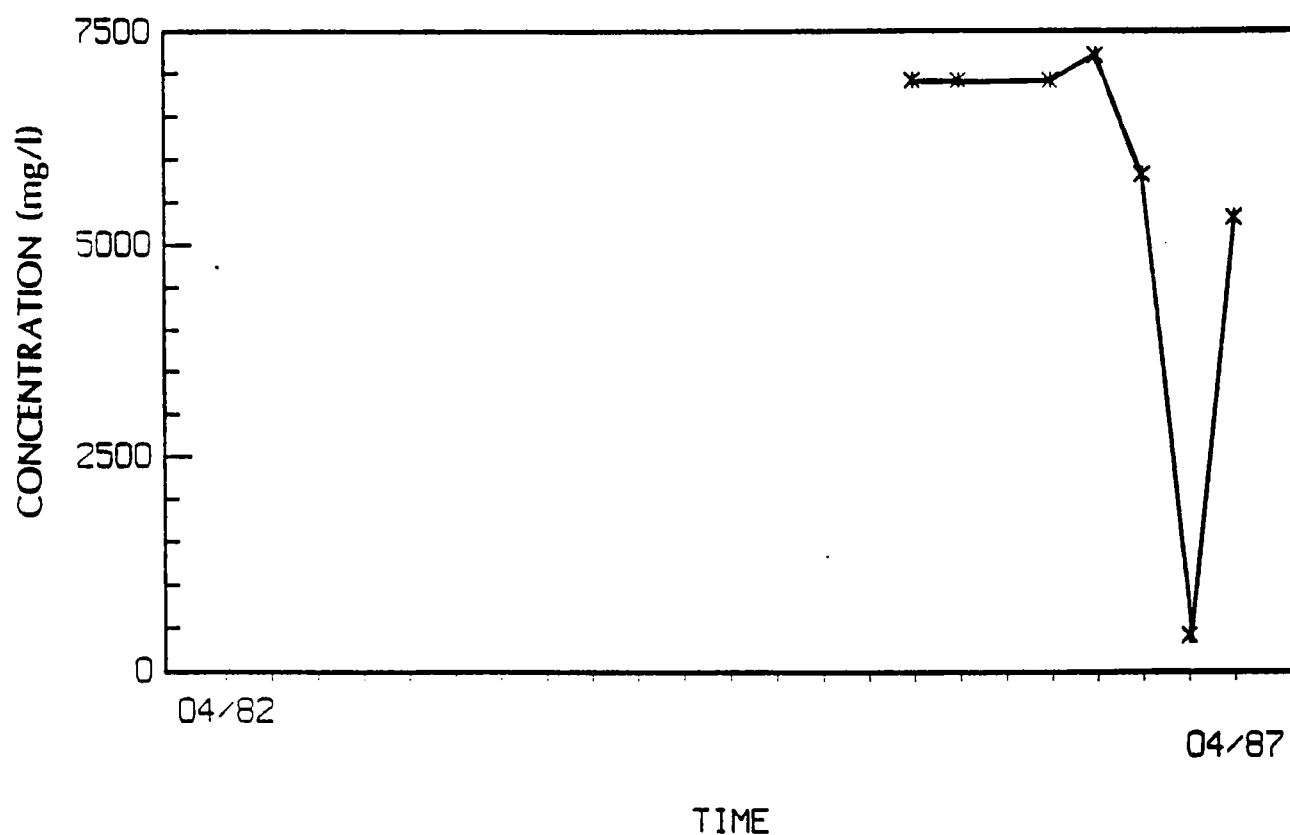


# CHLORIDE AT G-121S

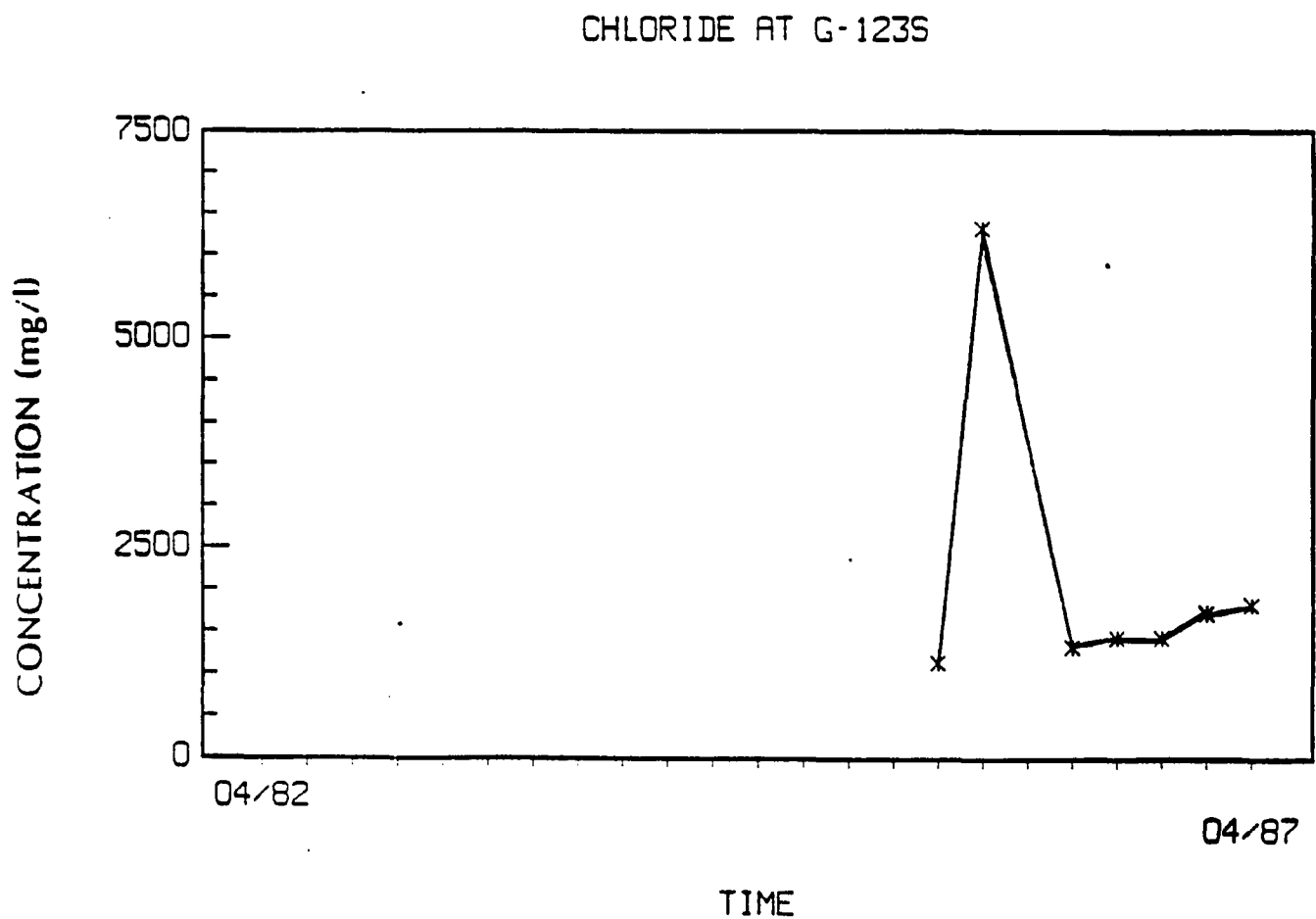


JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-14

# CHLORIDE AT G-122S

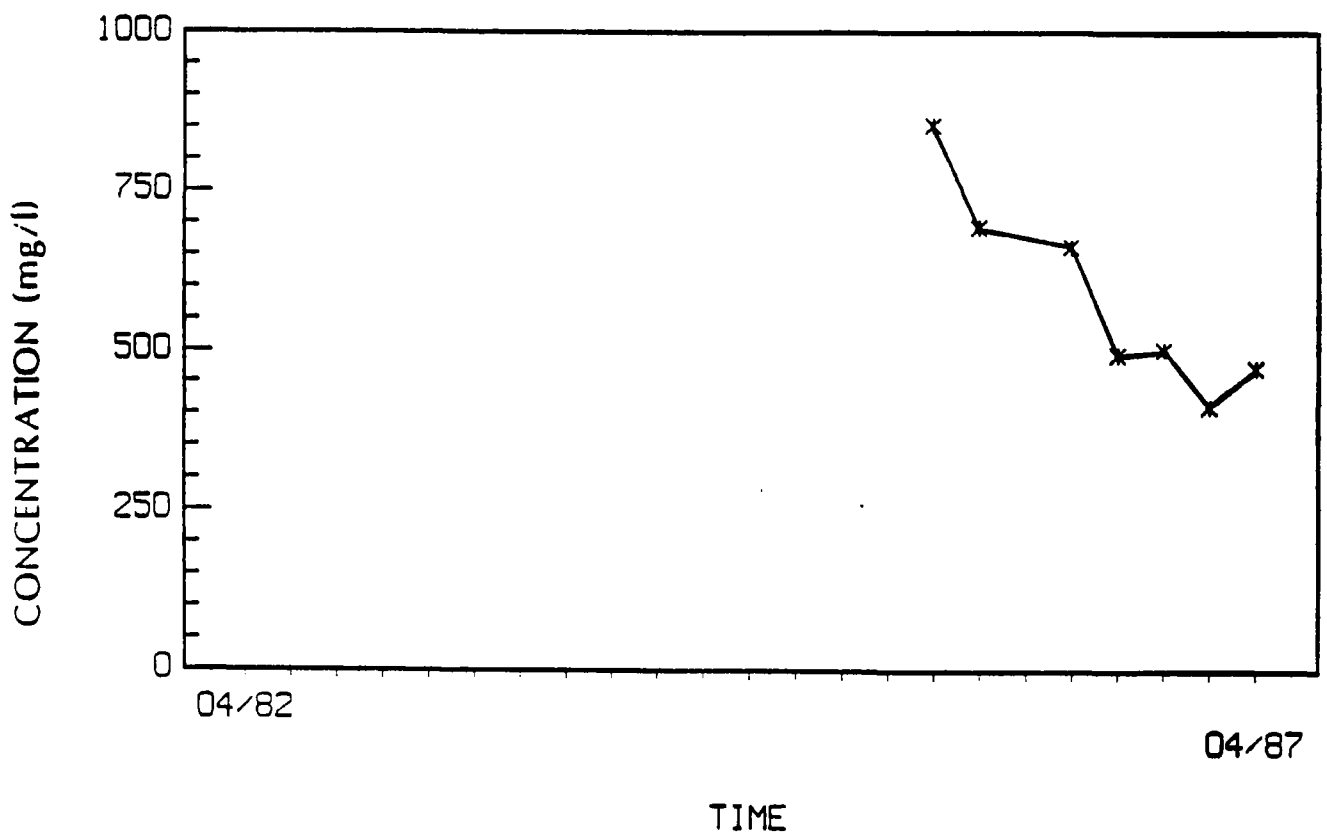


JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-15



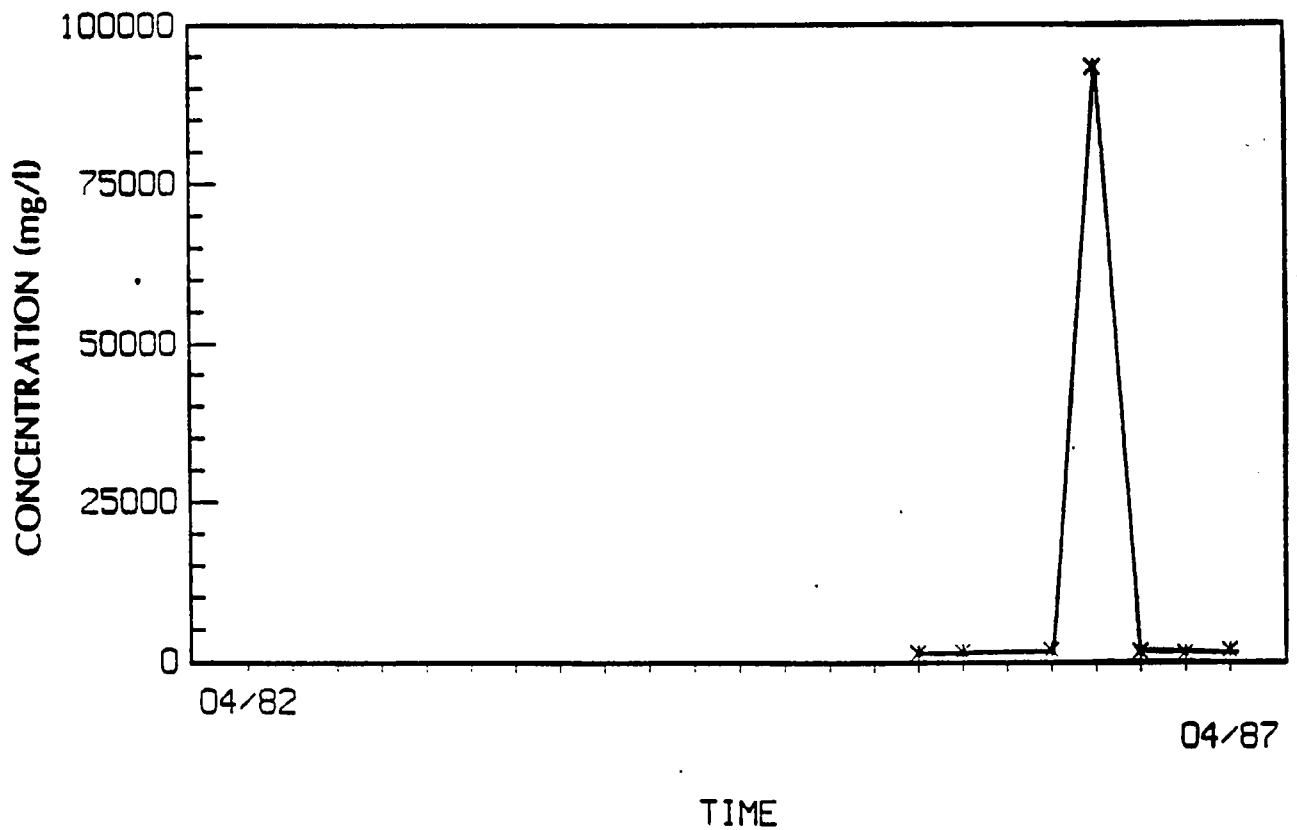
JOB NO.	873-2096	SCALE	N.T.S.	<b>TIME-TREND PLOTS</b> <b>SCA CHICAGO INCINERATOR</b>
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG. NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. <span style="float: right;">FIGURE 9-16</span>

# CHLORIDE AT G-124S



JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-1

# CHLORIDE AT G-125S



JOB NO.	873-2096	SCALE	N.T.S.
DRAWN	LWK	DATE	7/28/87
CHECKED		DWG. NO.	

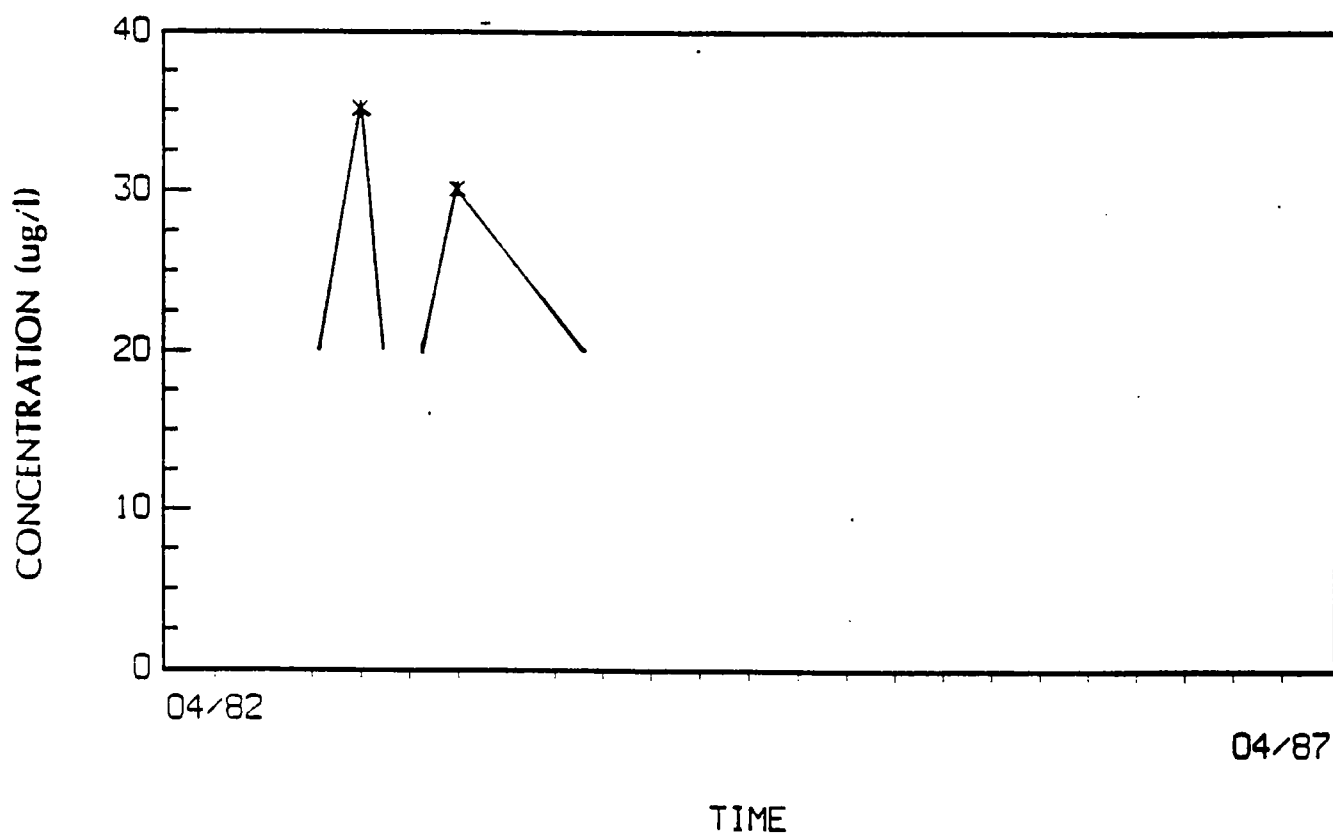
TIME-TREND PLOTS  
SCA CHICAGO INCINERATOR

Golder Associates

CHEMICAL WASTE MANAGEMENT, INC.

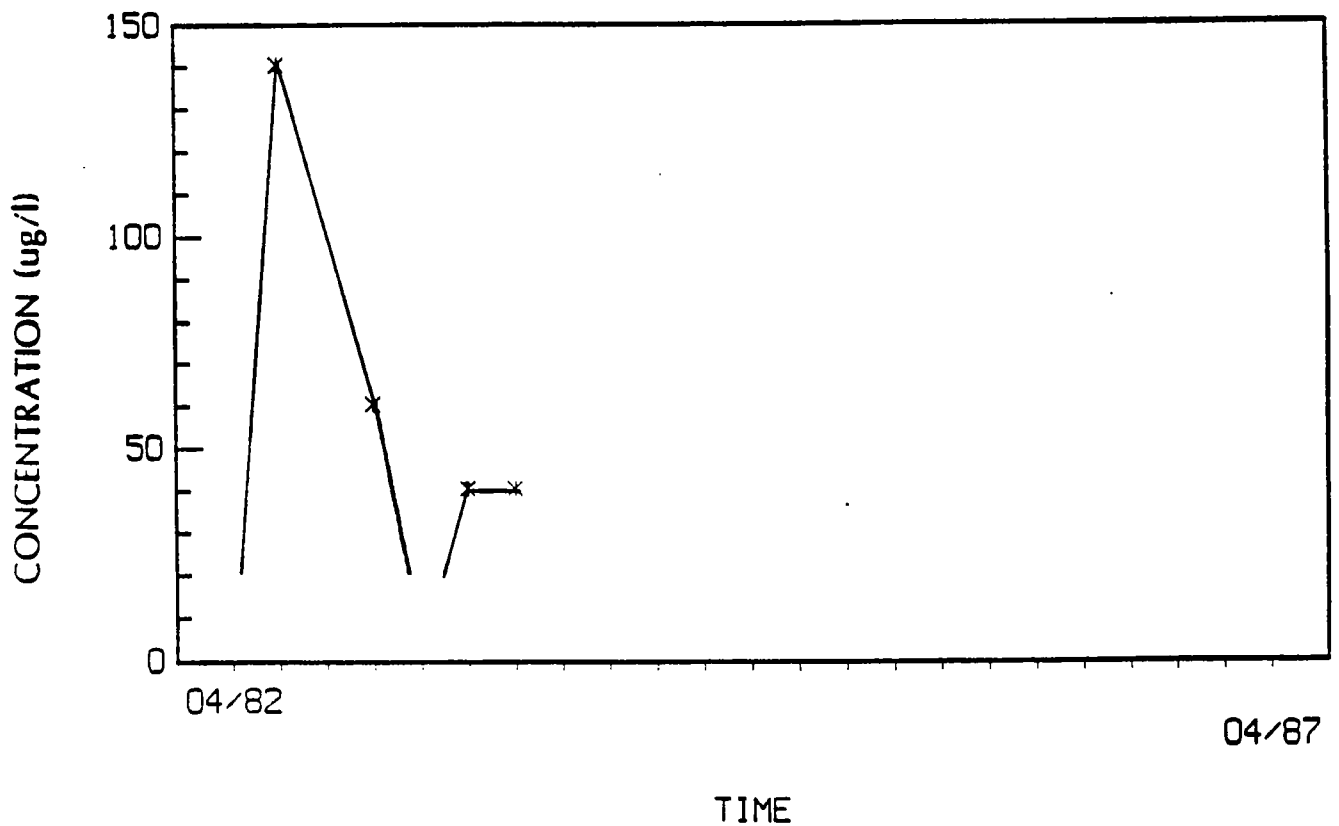
FIGURE 9-18

# CHROMIUM AT G-110



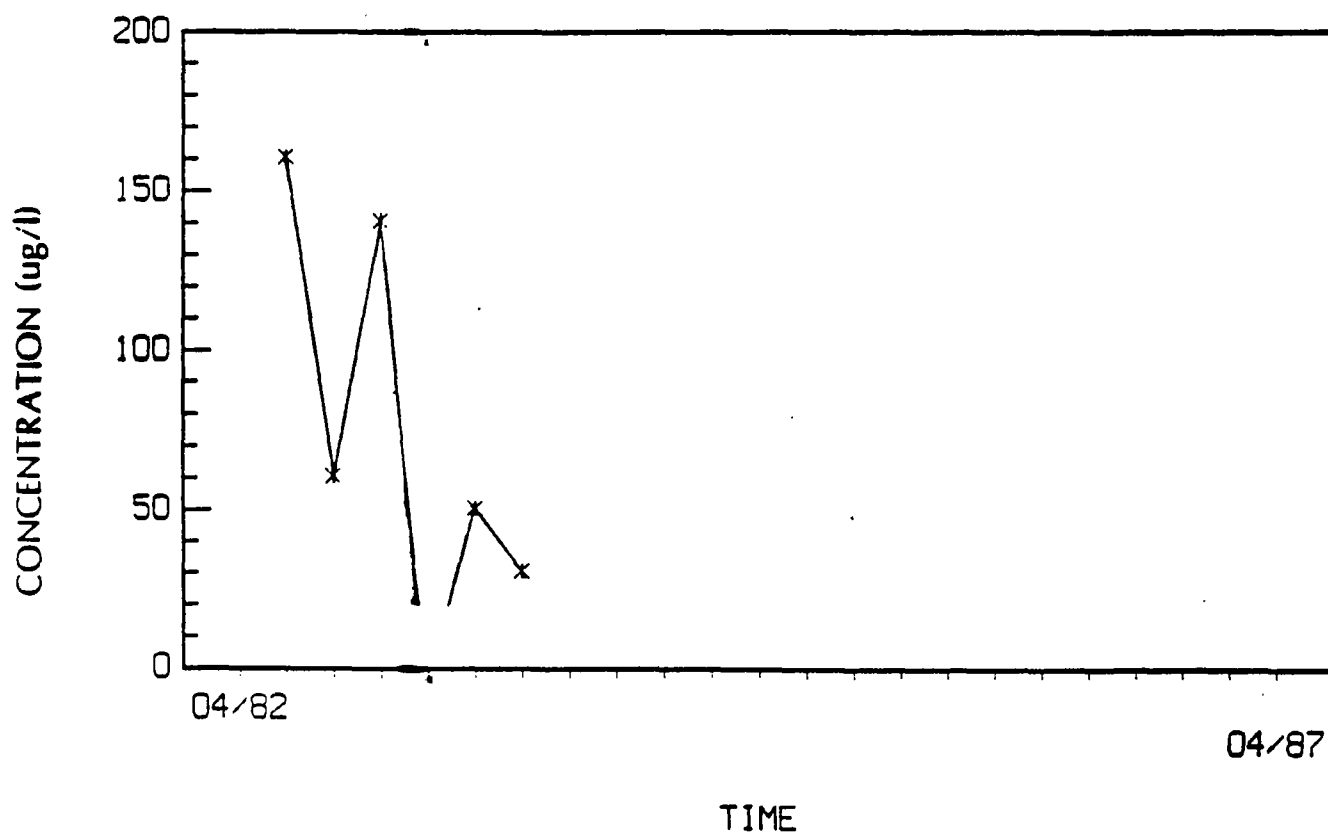
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-1

# CHROMIUM AT G-111A



JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-2C

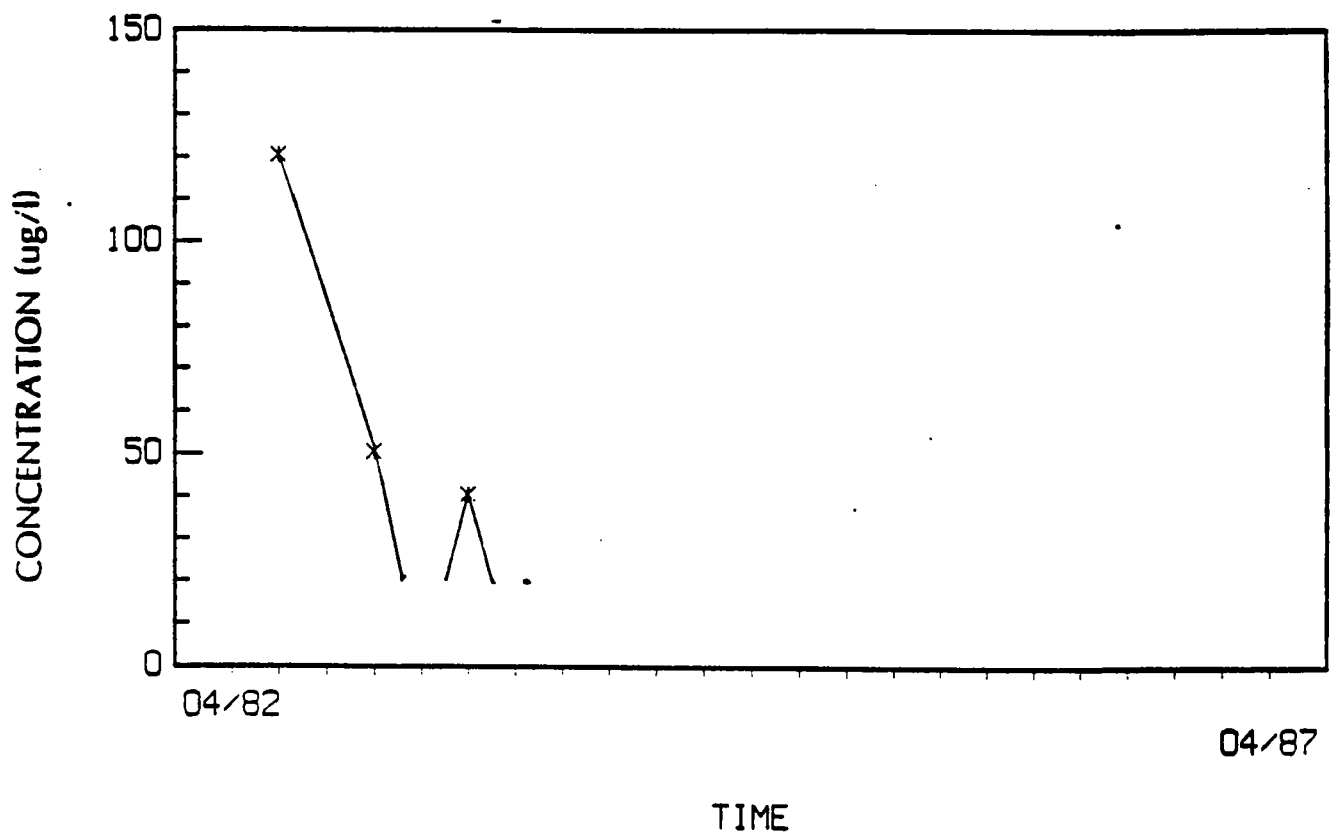
# CHROMIUM AT G-112B



JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG. NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 9-21

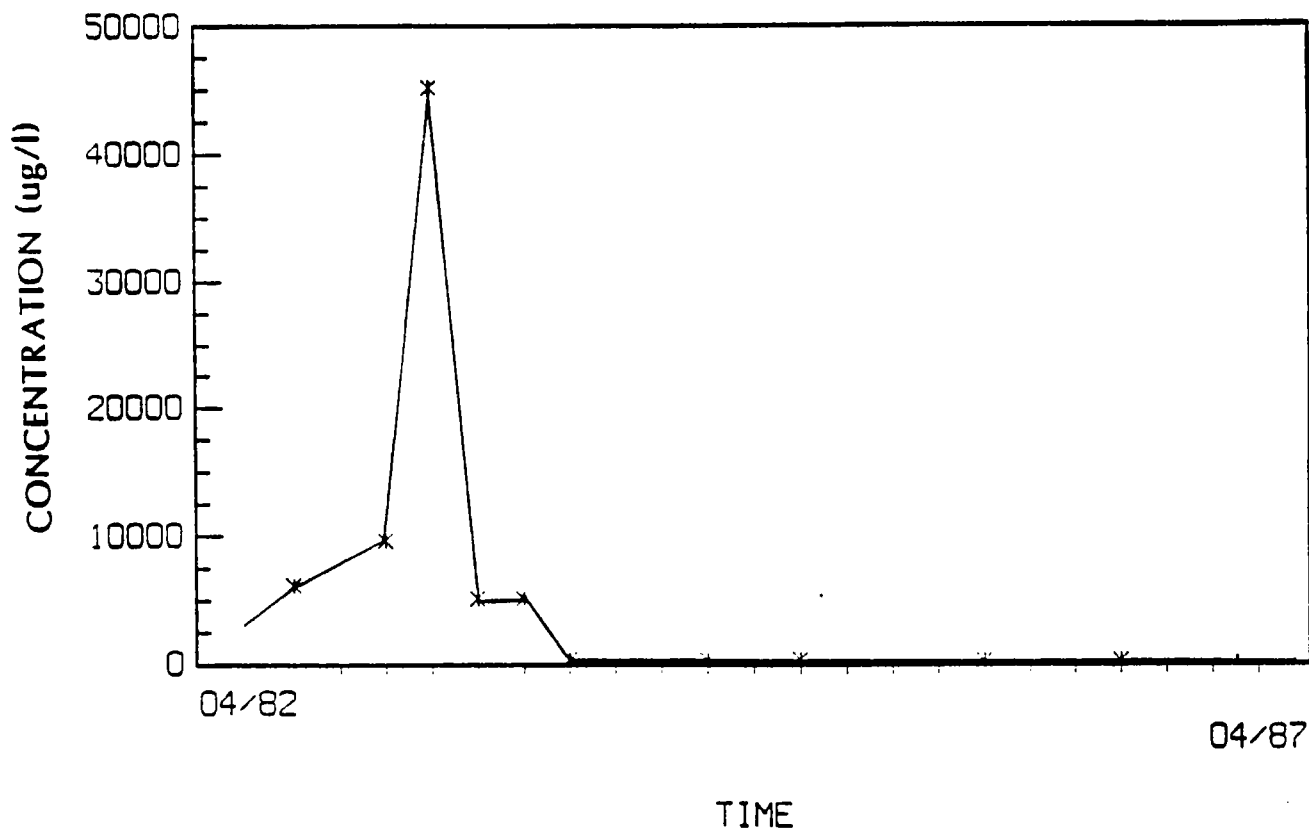


# CHROMIUM AT G-113A



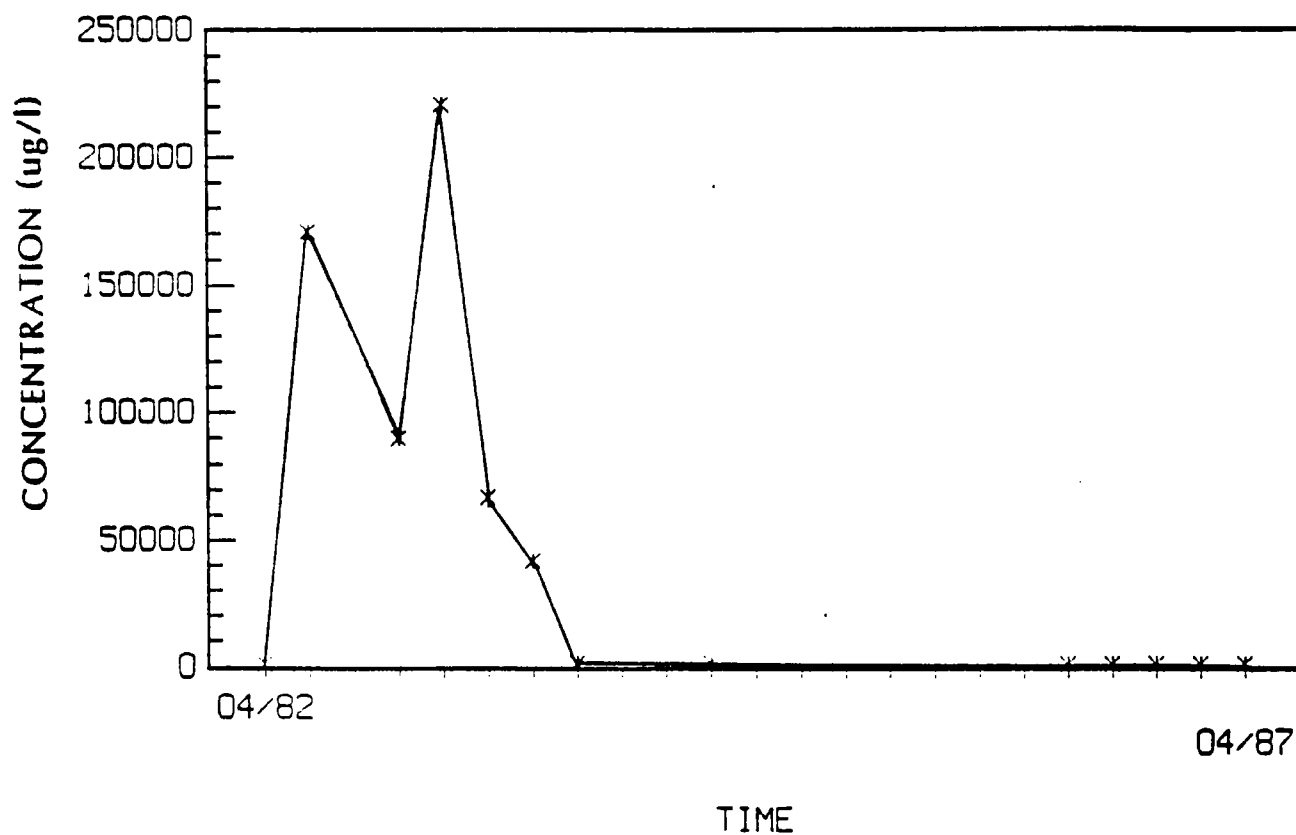
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-22

# IRON AT G-110



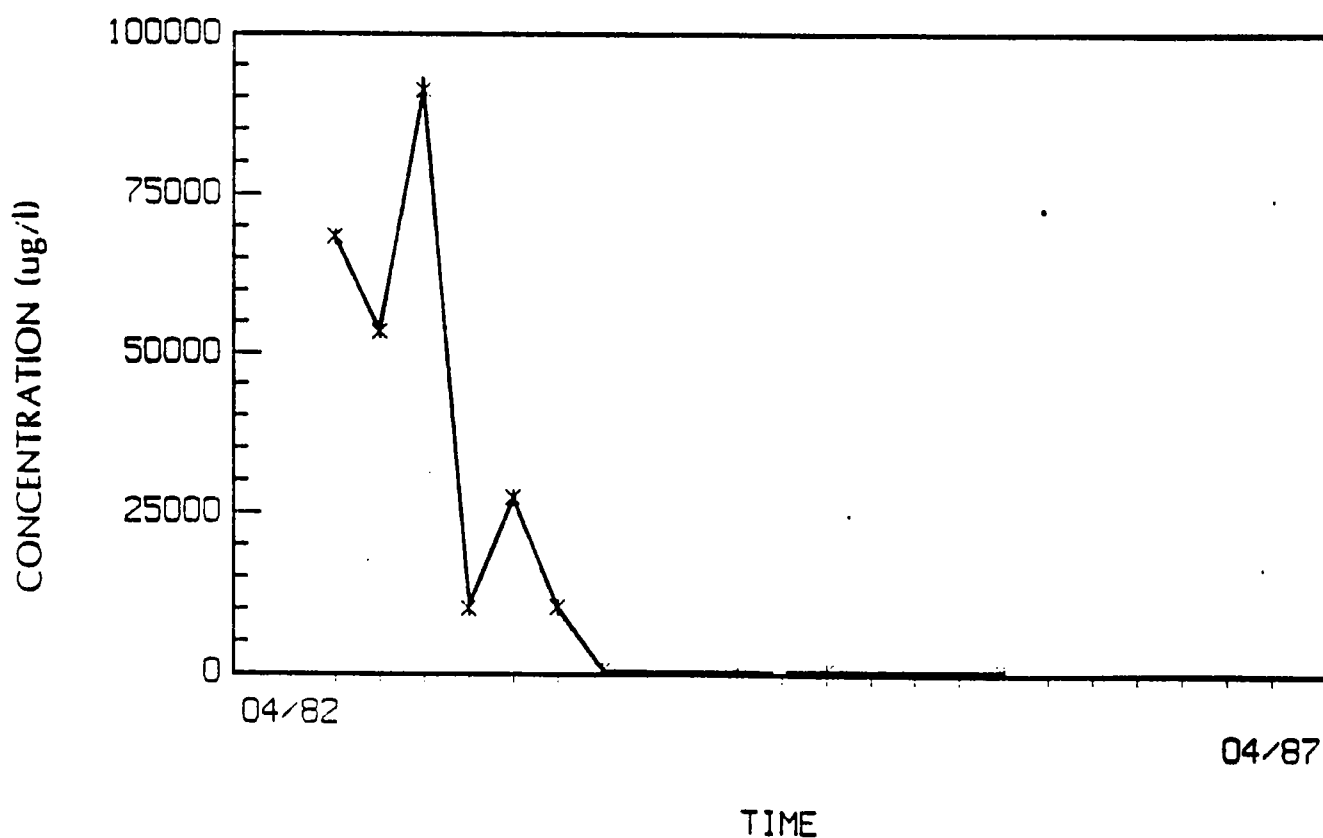
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG. NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 9-23

# IRON AT G-111A



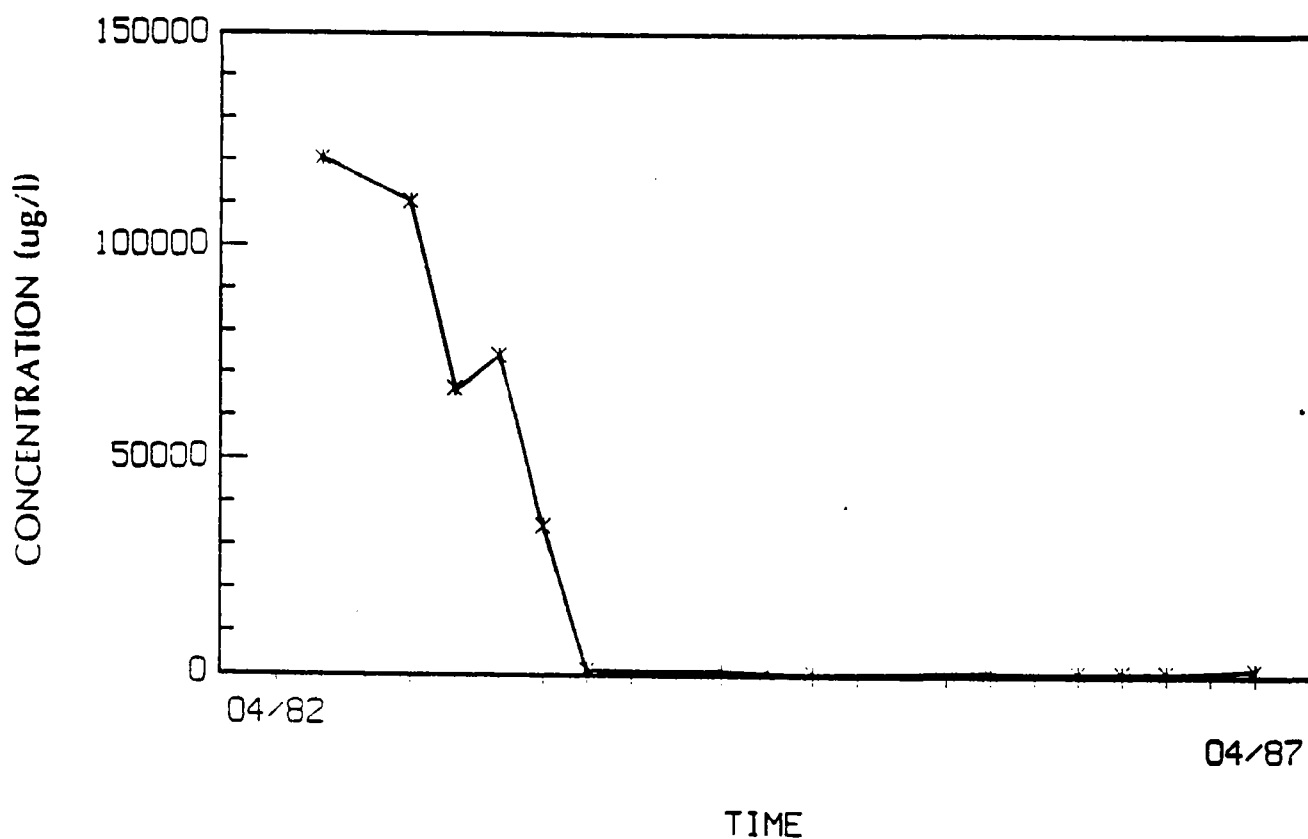
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG. NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 9-24

# IRON AT G-112B



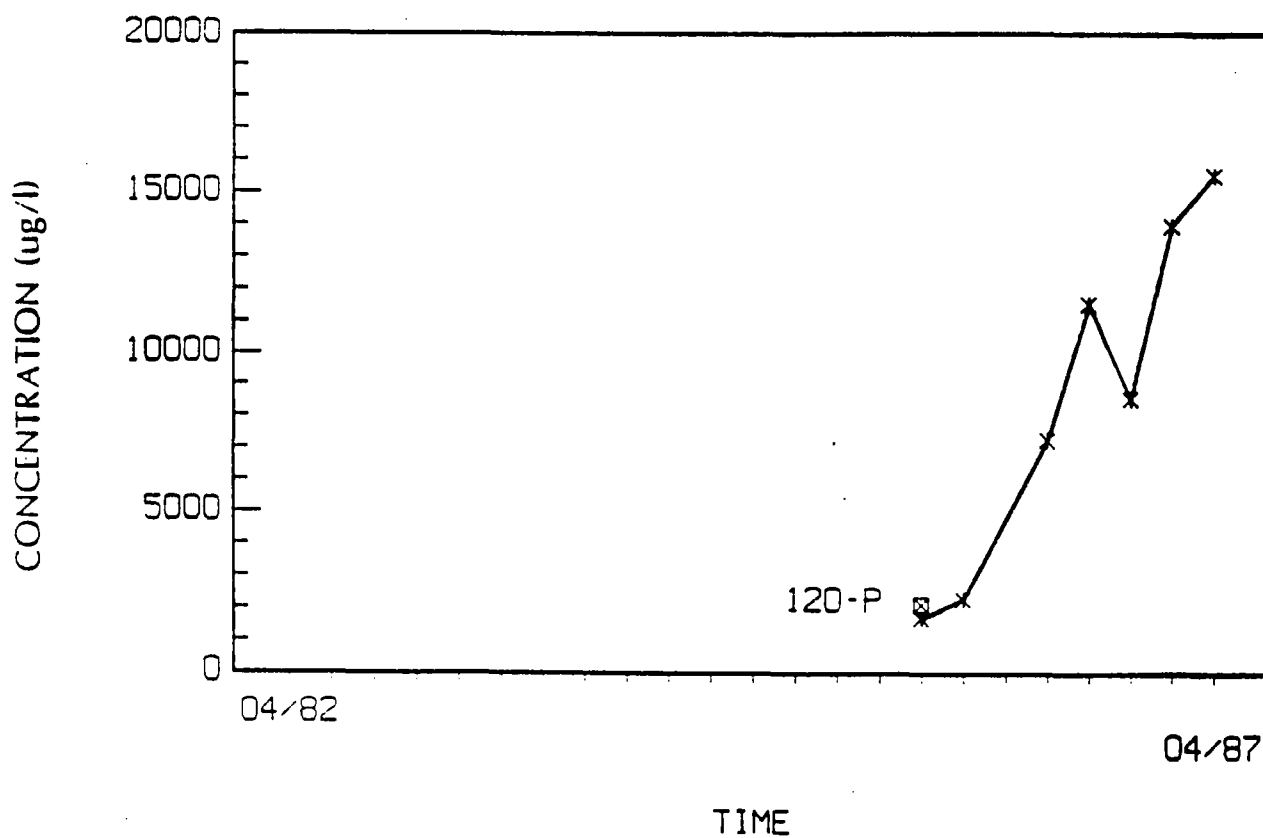
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-2

# IRON AT G-113A



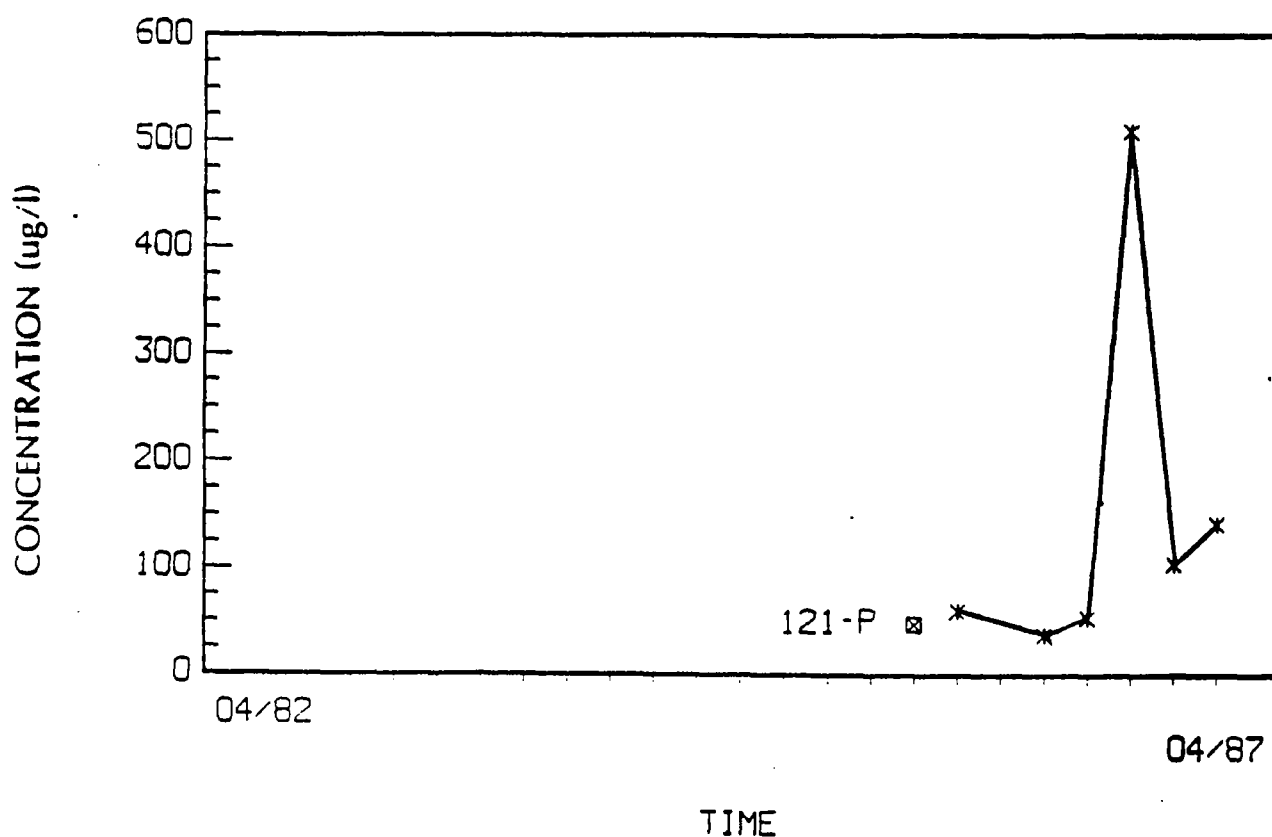
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-2

# IRON AT G-12CS



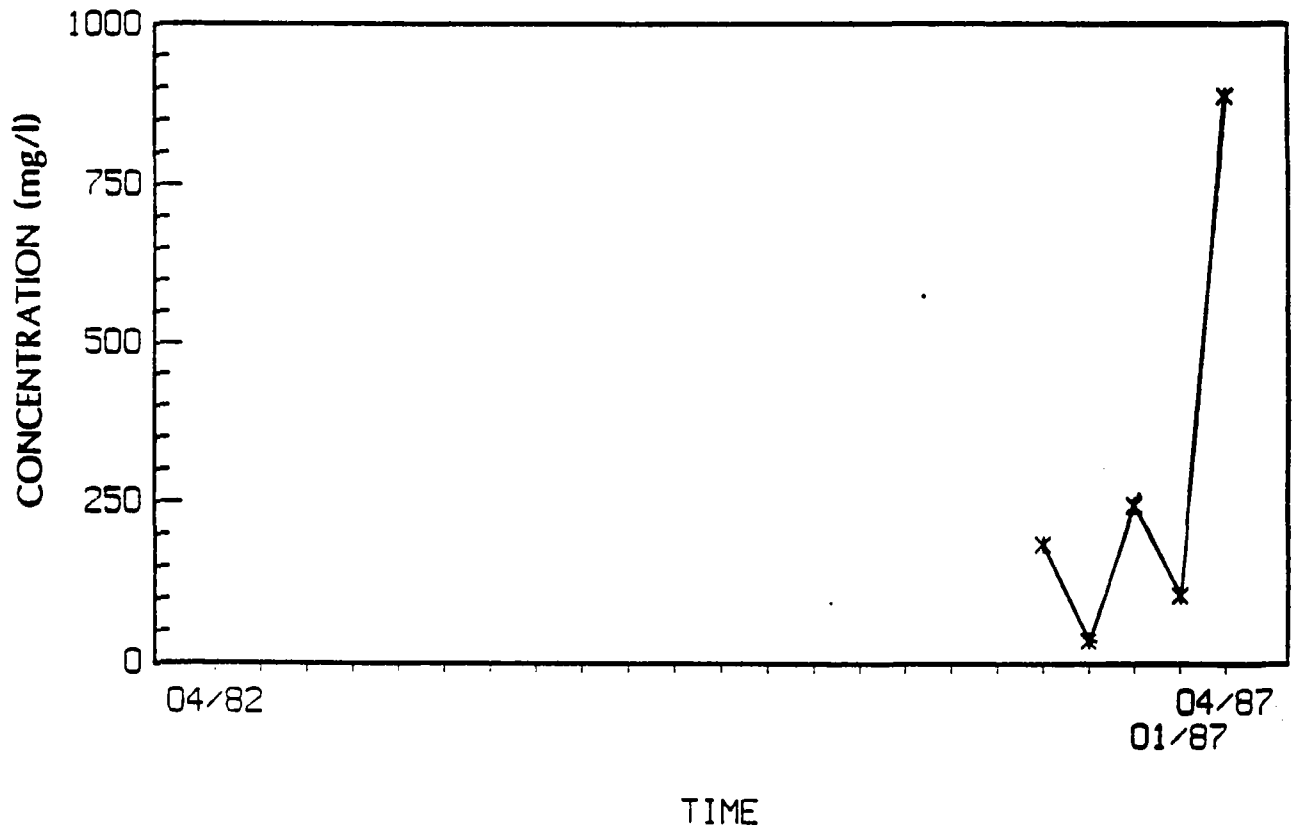
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG. NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 9-2

# IRON AT G-121S



JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG. NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 9-2E

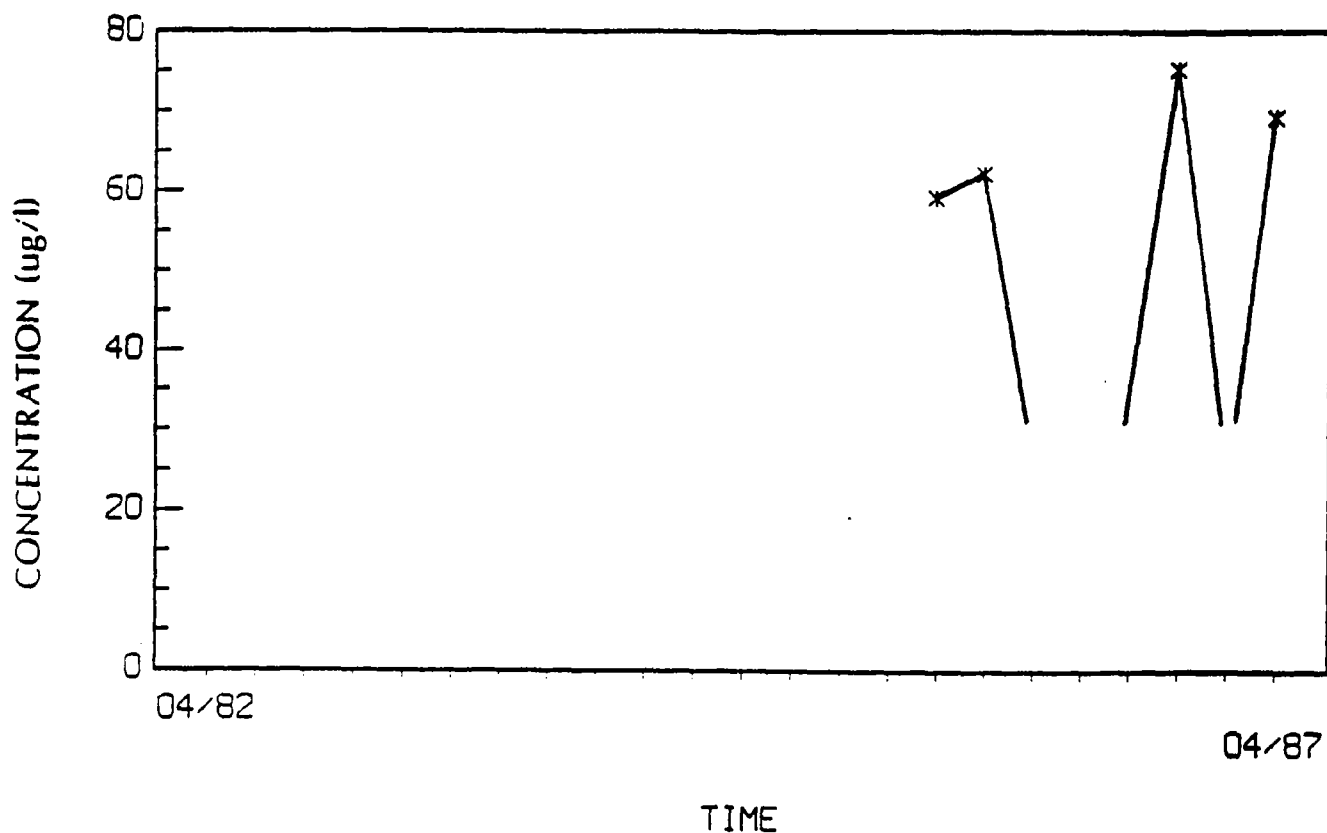
# IRON AT G-1225



JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-29

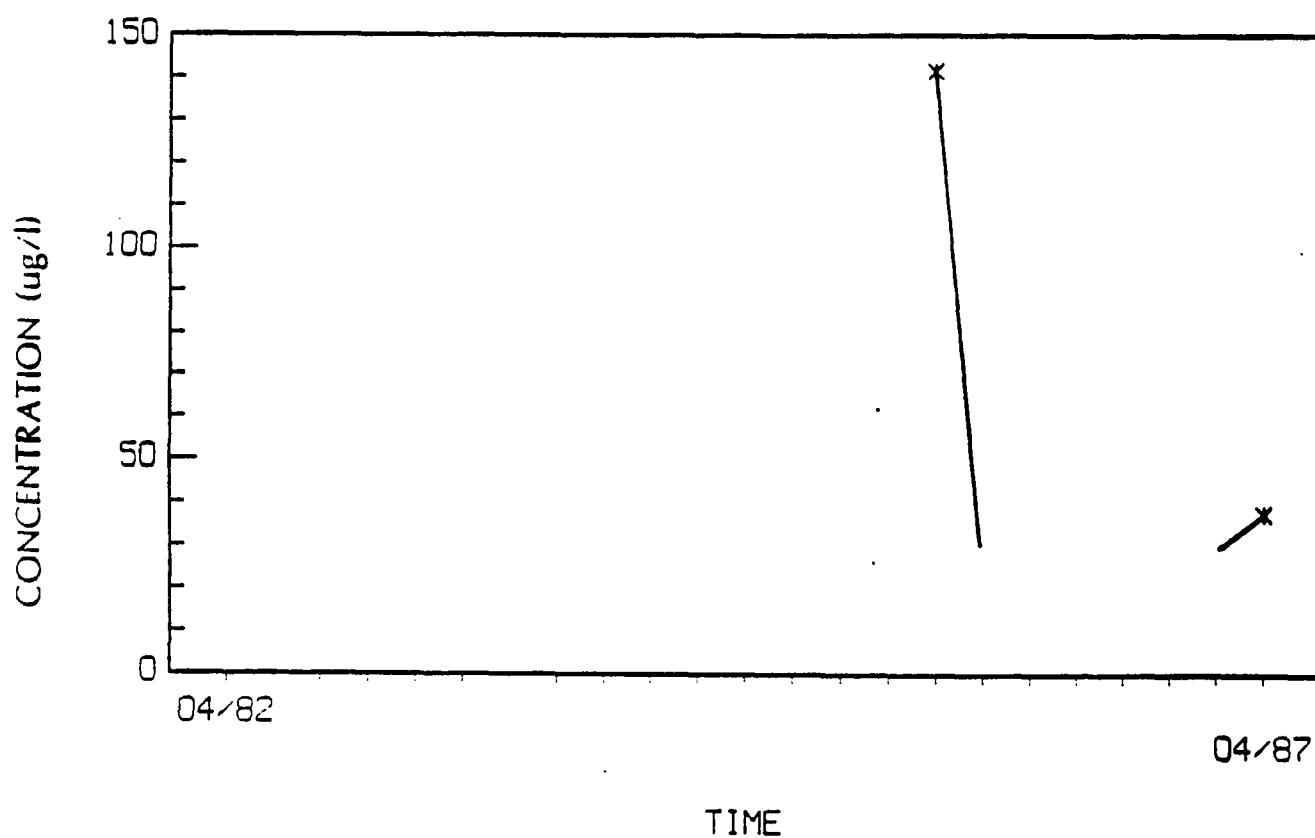


# IRON AT G-123S



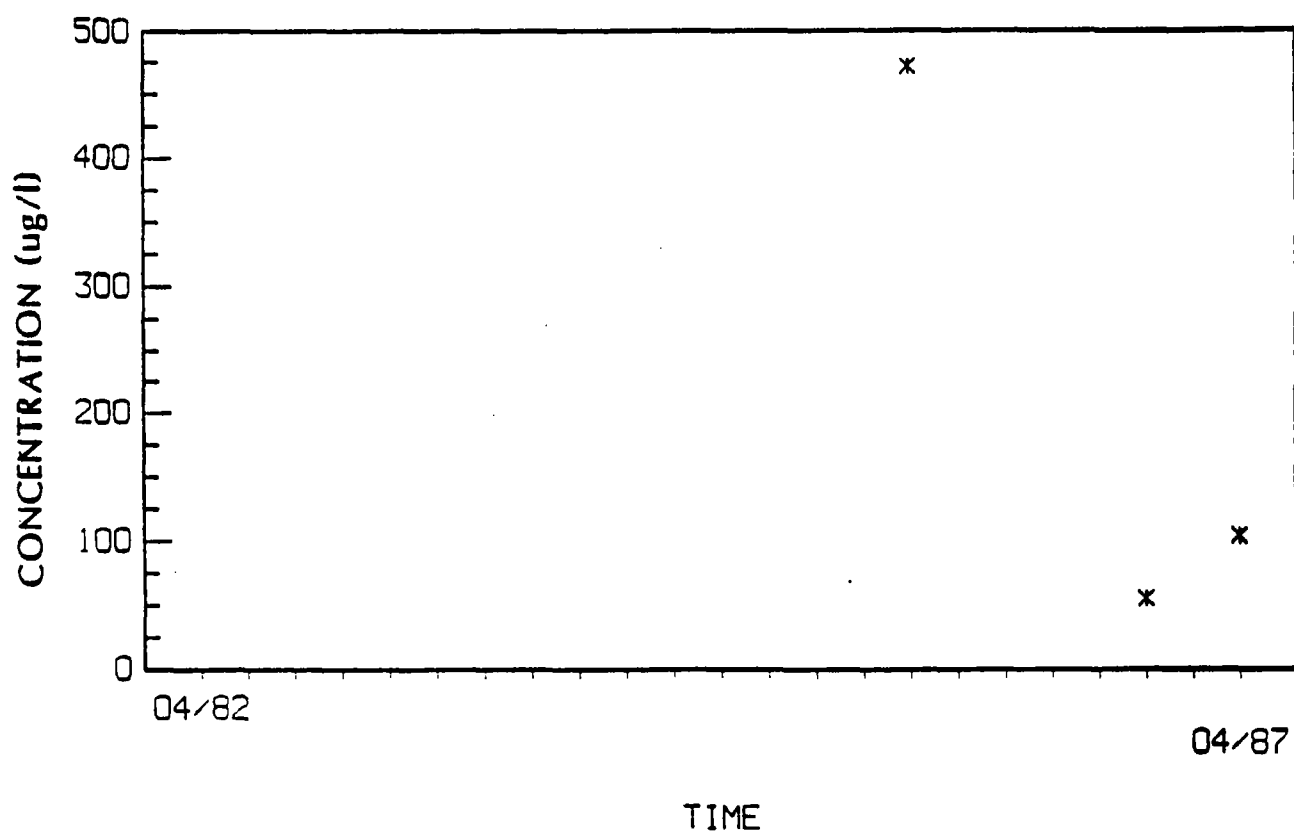
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-3

# IRON AT G-124S



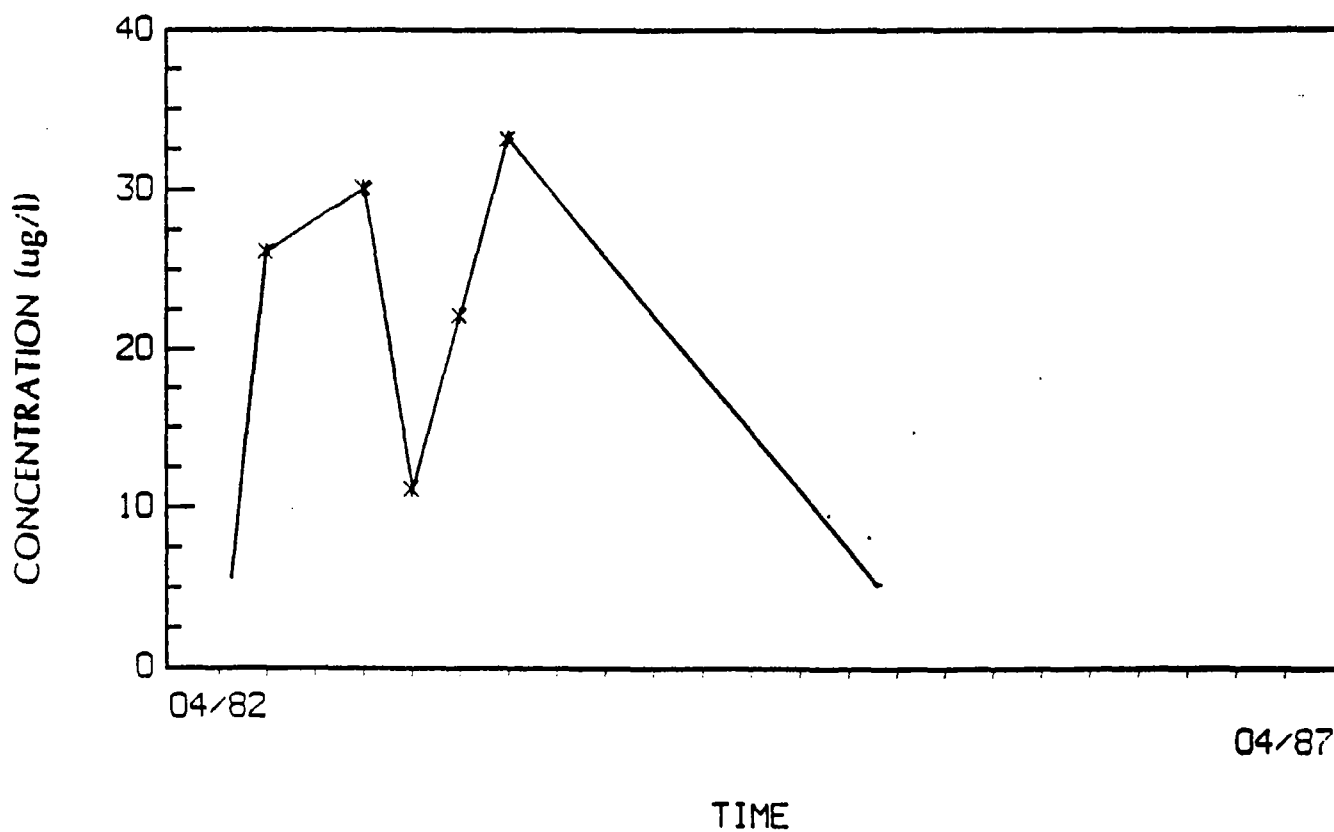
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-31

# IRON AT G-1255



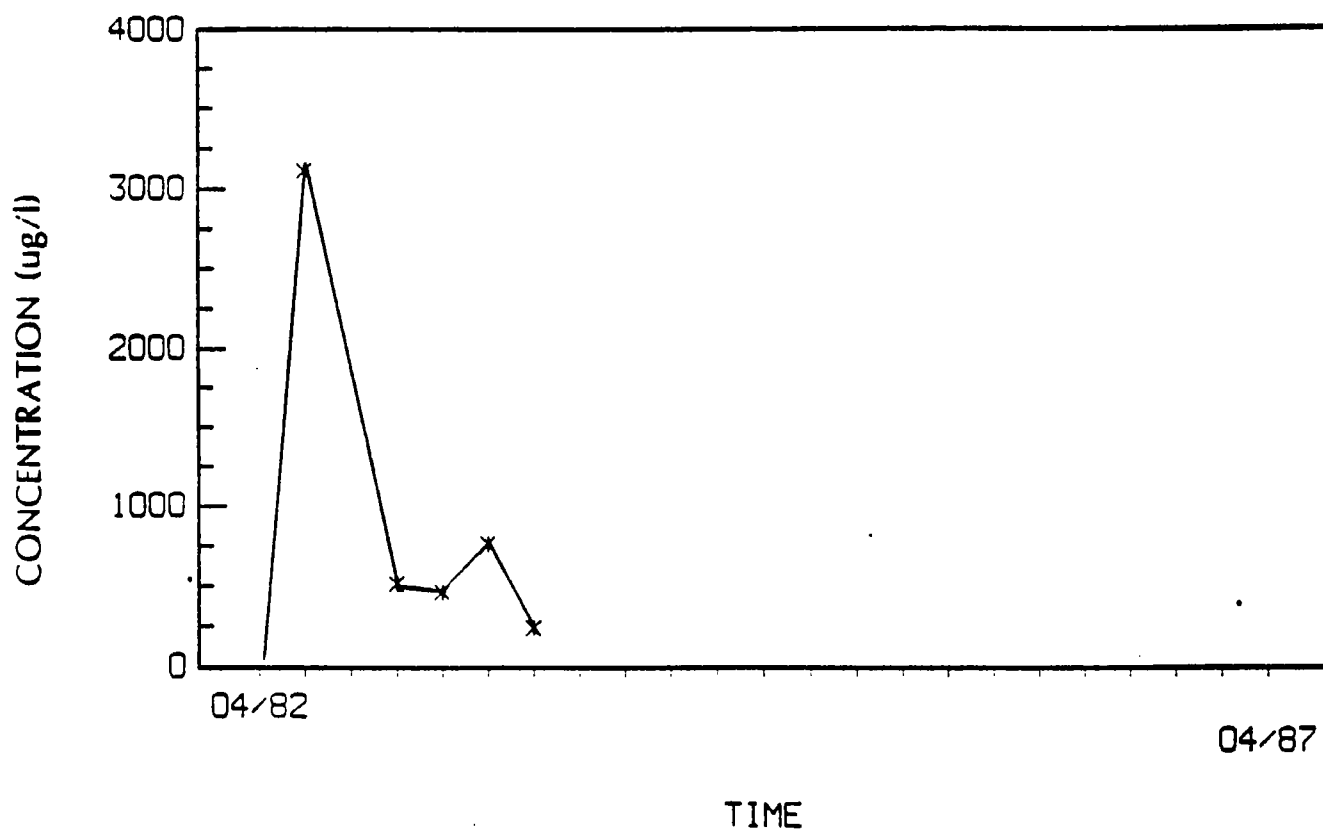
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-32

# LEAD AT G-110



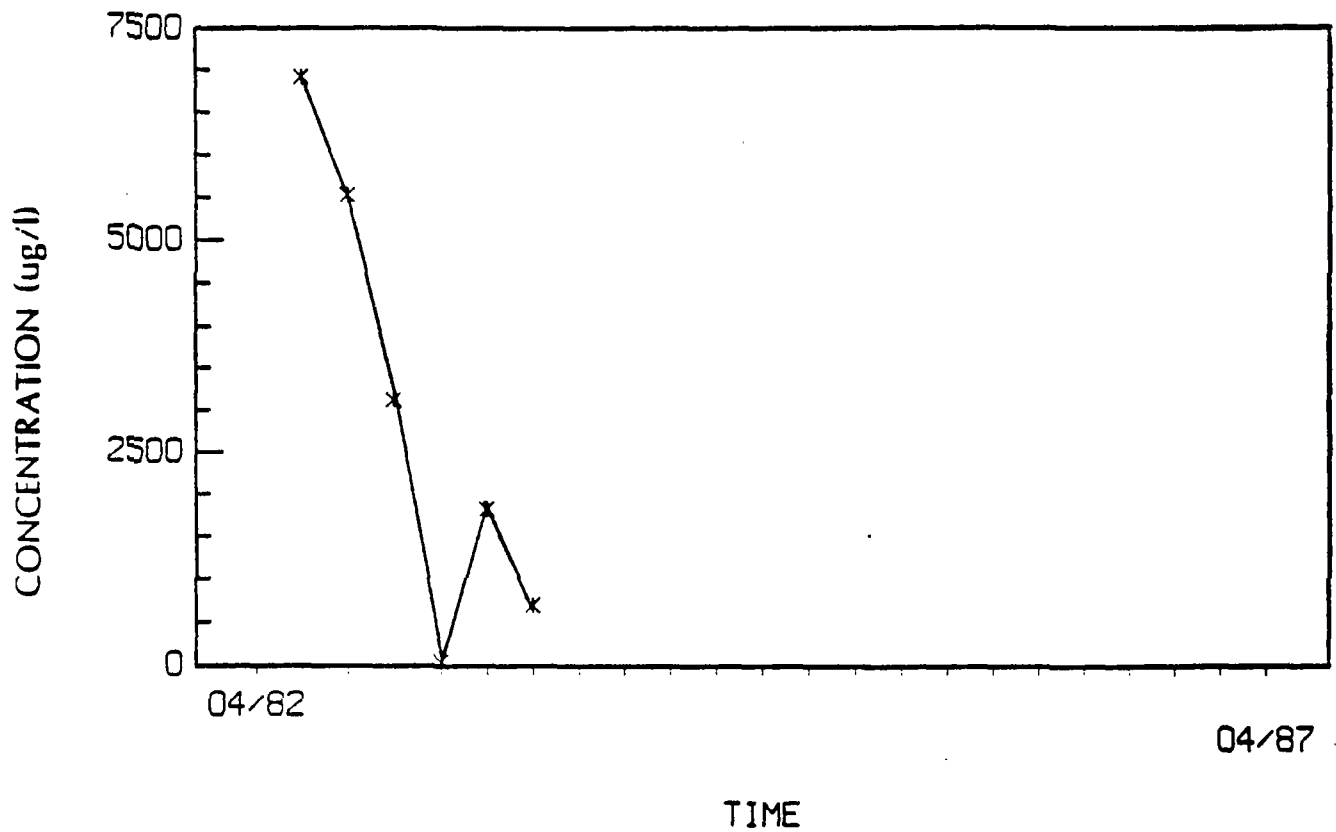
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-33

# LEAD AT G-111A



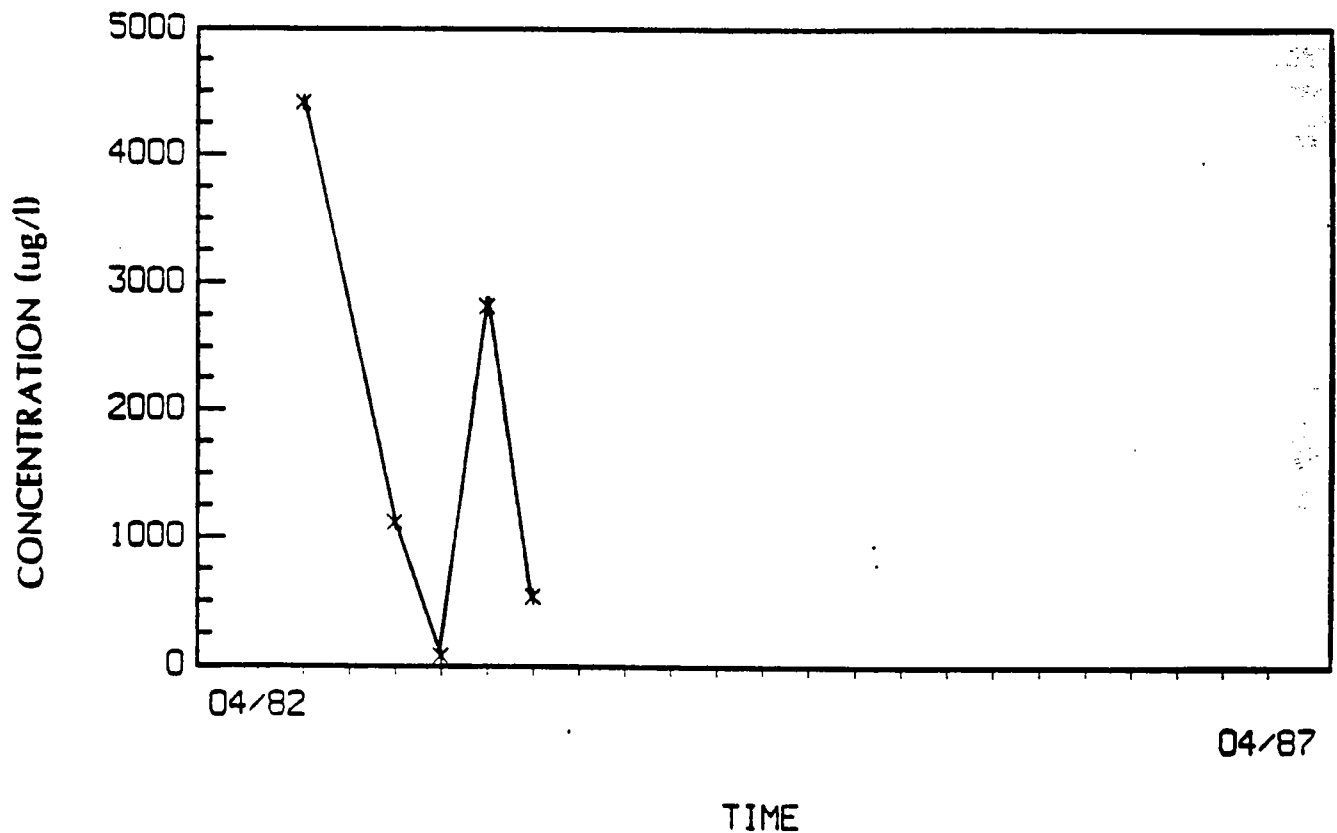
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-34

LEAD G-112B



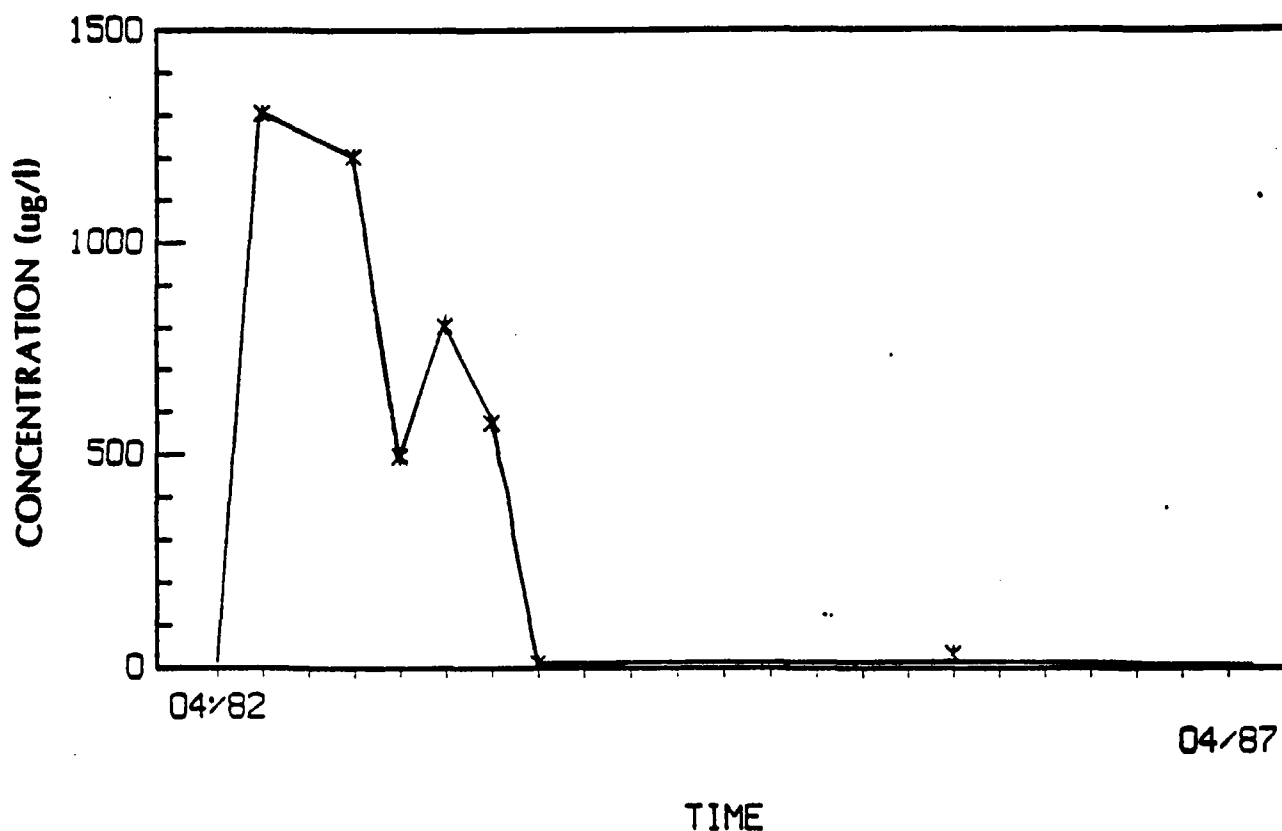
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-35

# LEAD AT G-113A



JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-36

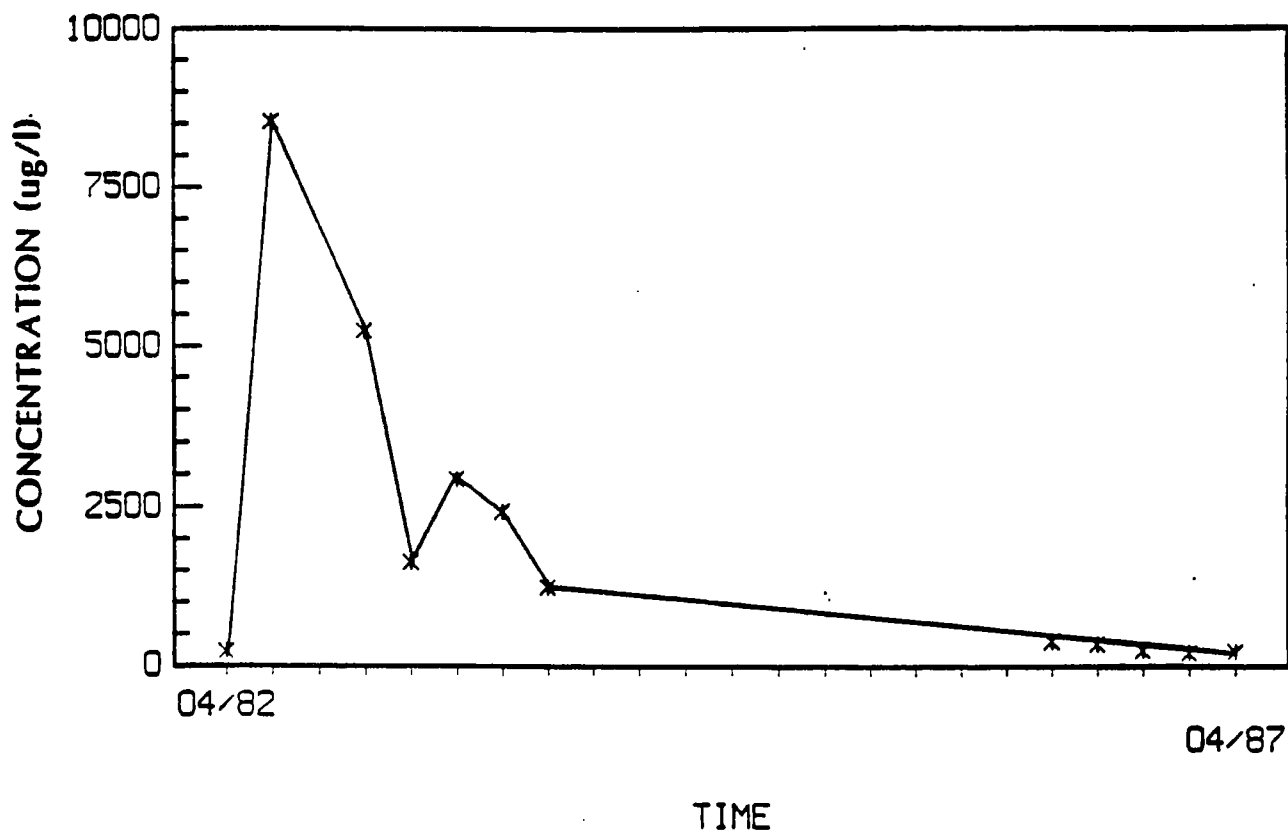
# MANGANESE AT G-110



JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE.	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-37

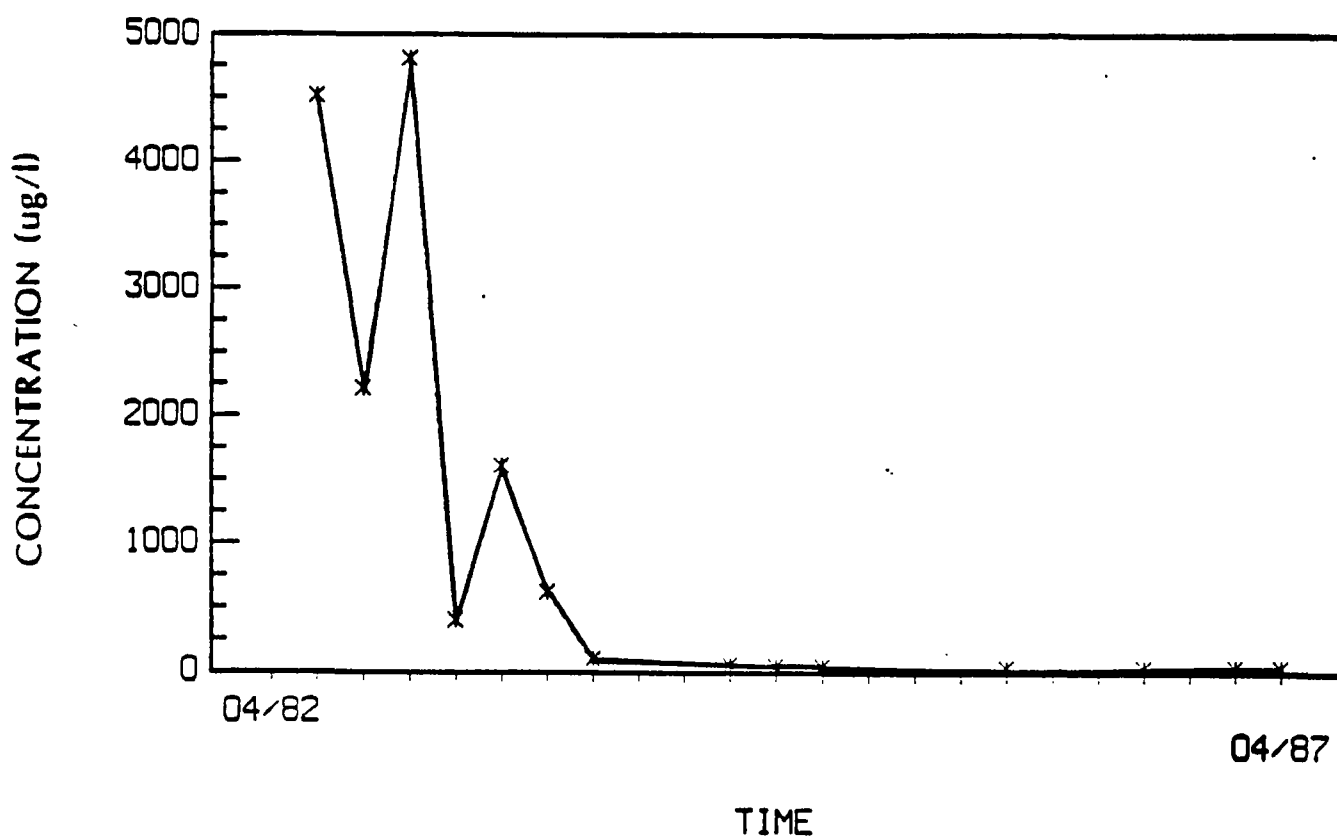


# MANGANESE AT G-111A



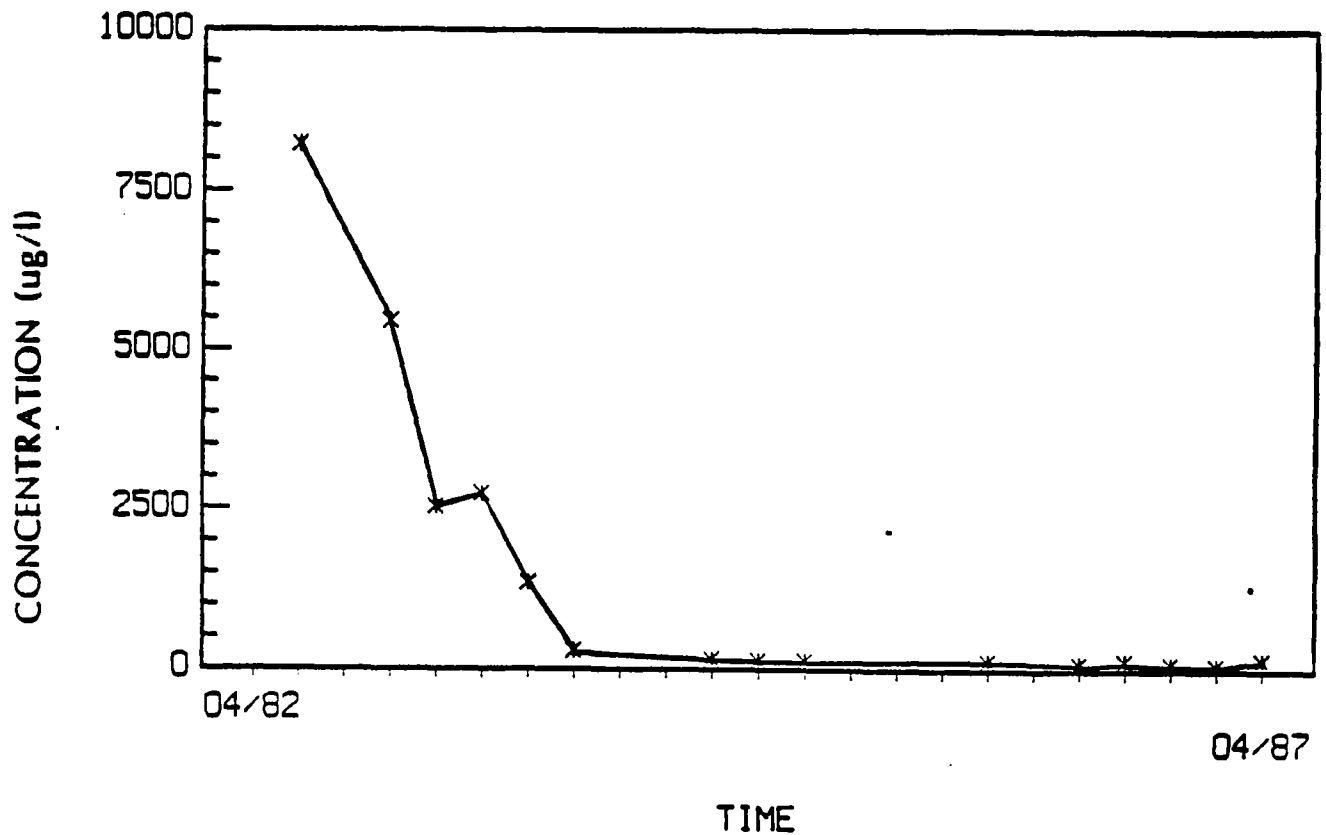
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG. NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 9-38

# MANGANESE AT G-112B



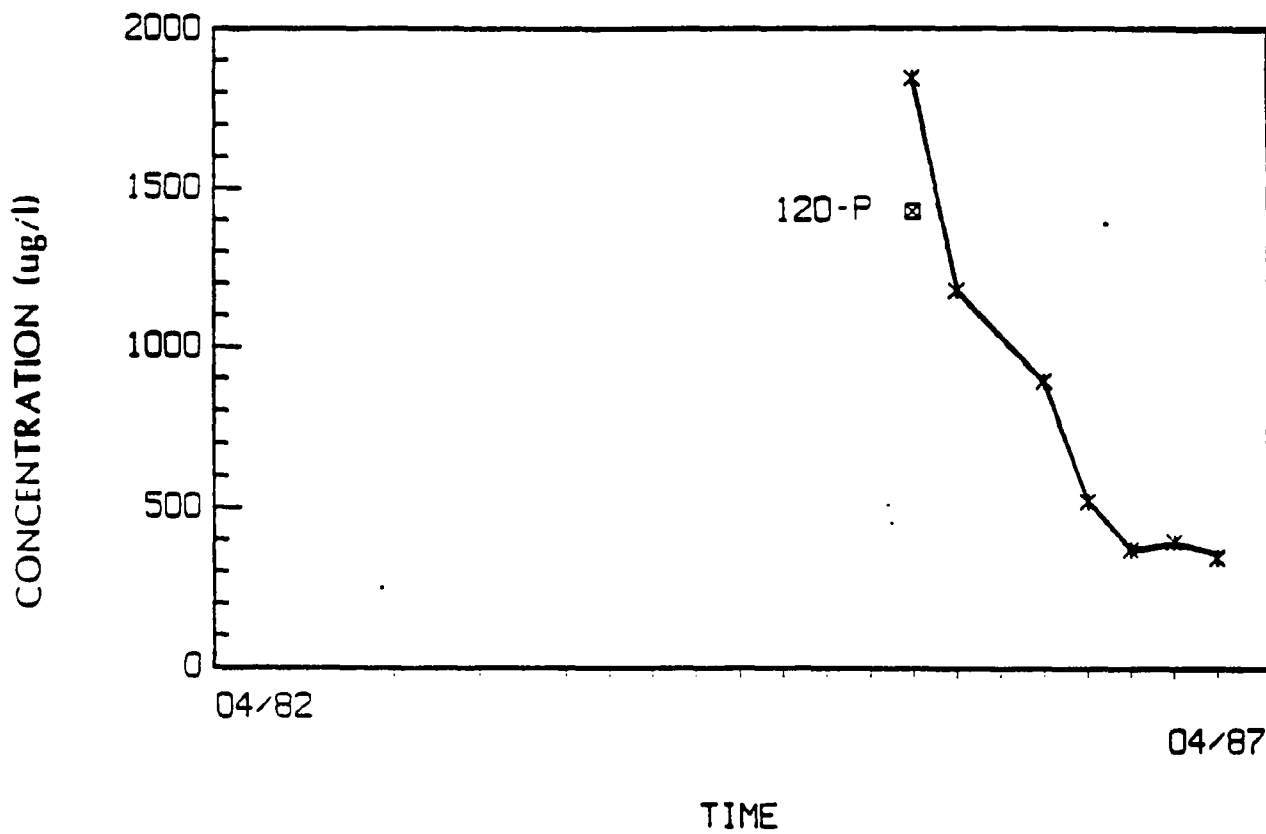
3 NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG. NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 9-39

# MANGANESE AT G-113A



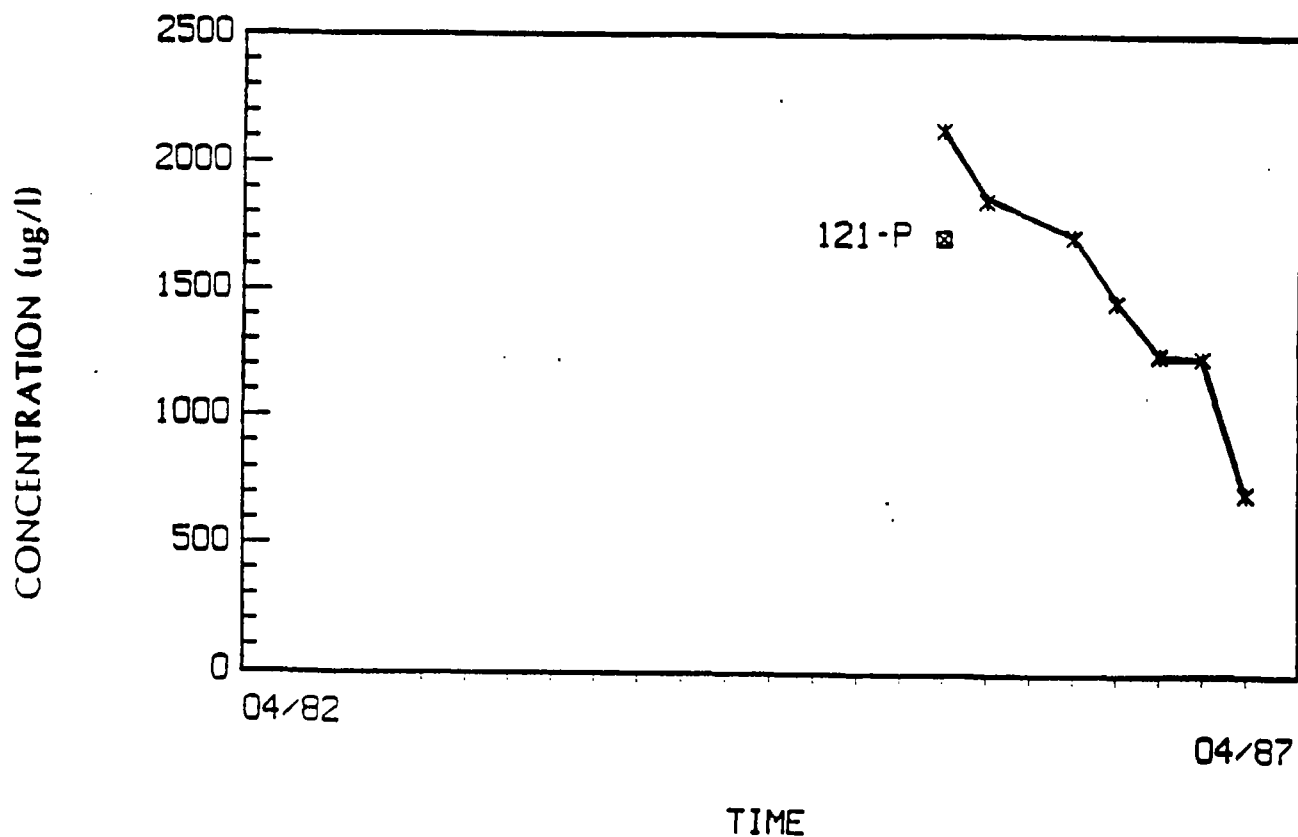
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-40

# MANGANESE AT G-120S



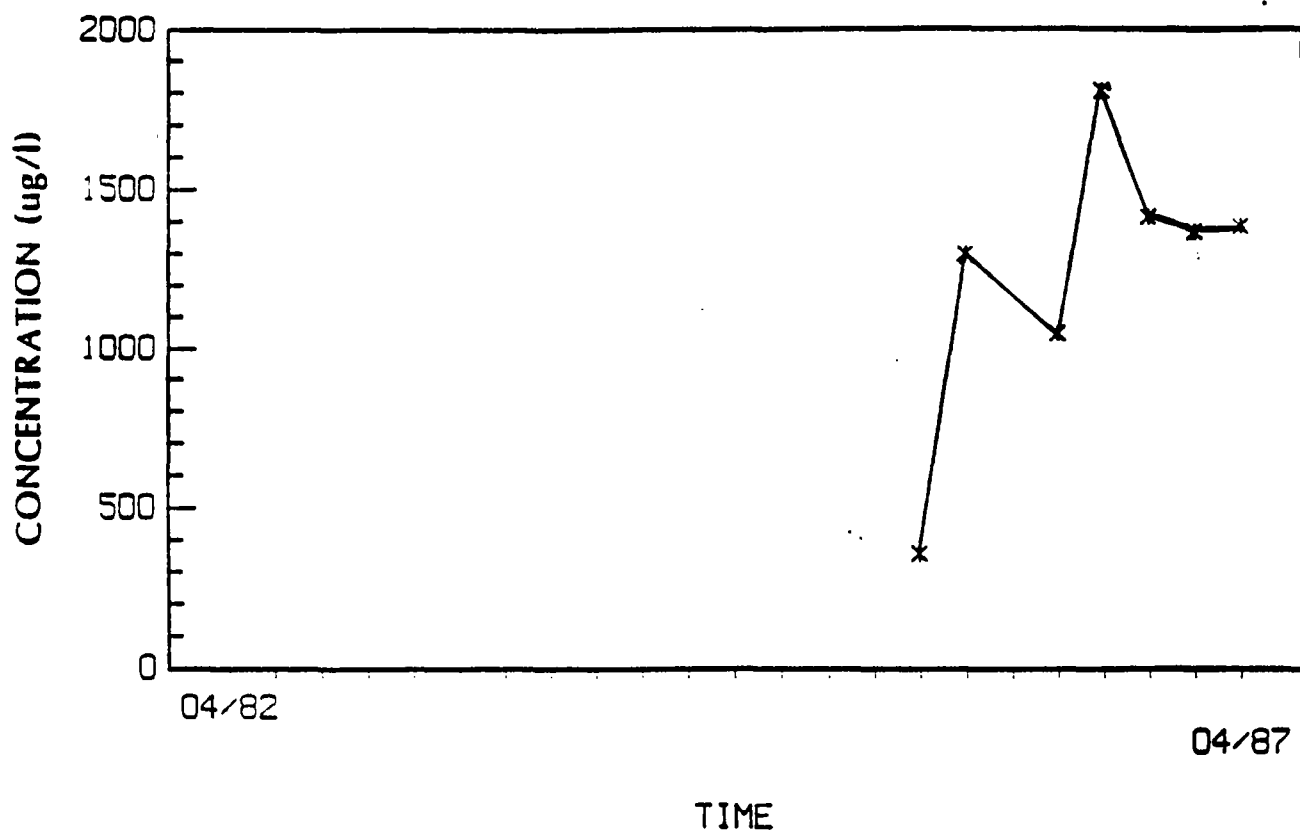
JB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-4

# MANGANESE AT G-1215



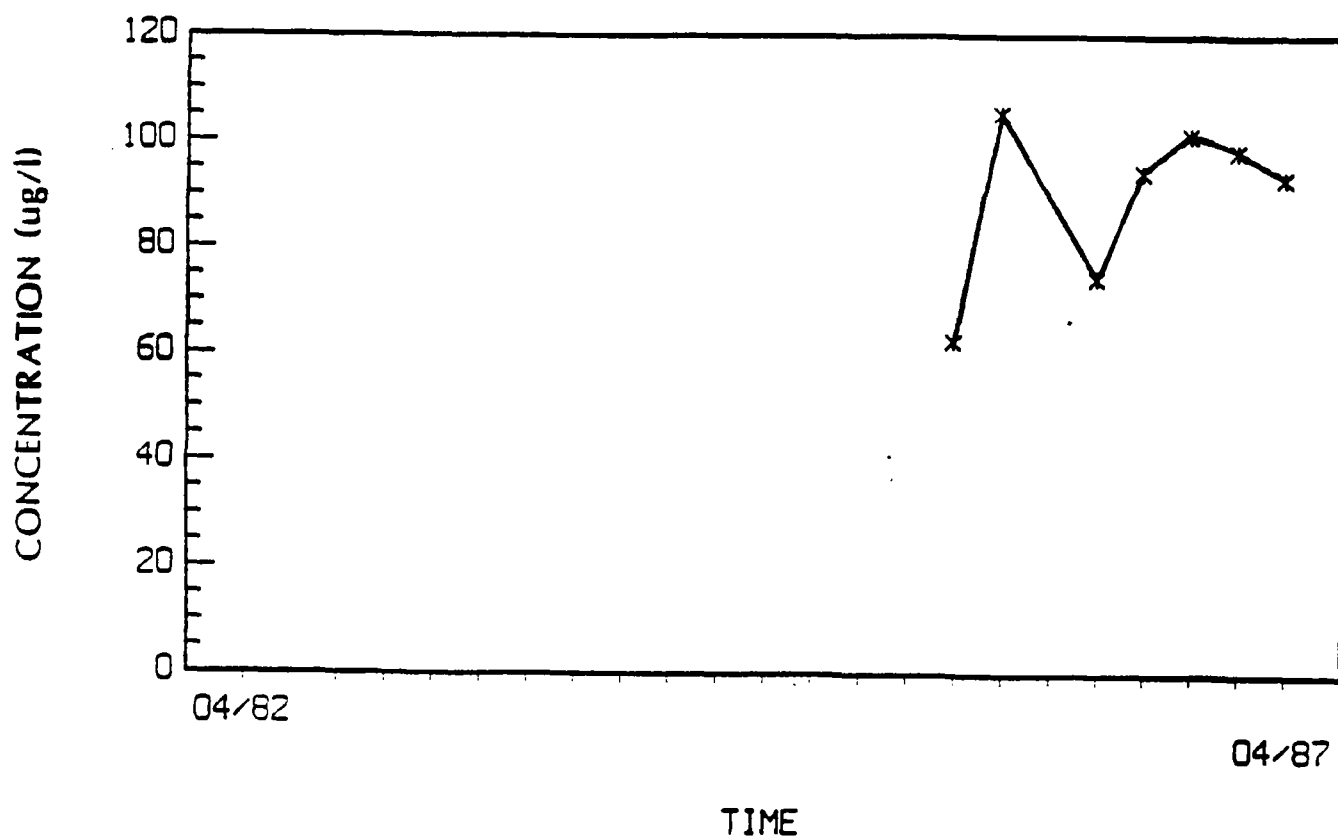
LAB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-4

# MANGANESE AT G-122S



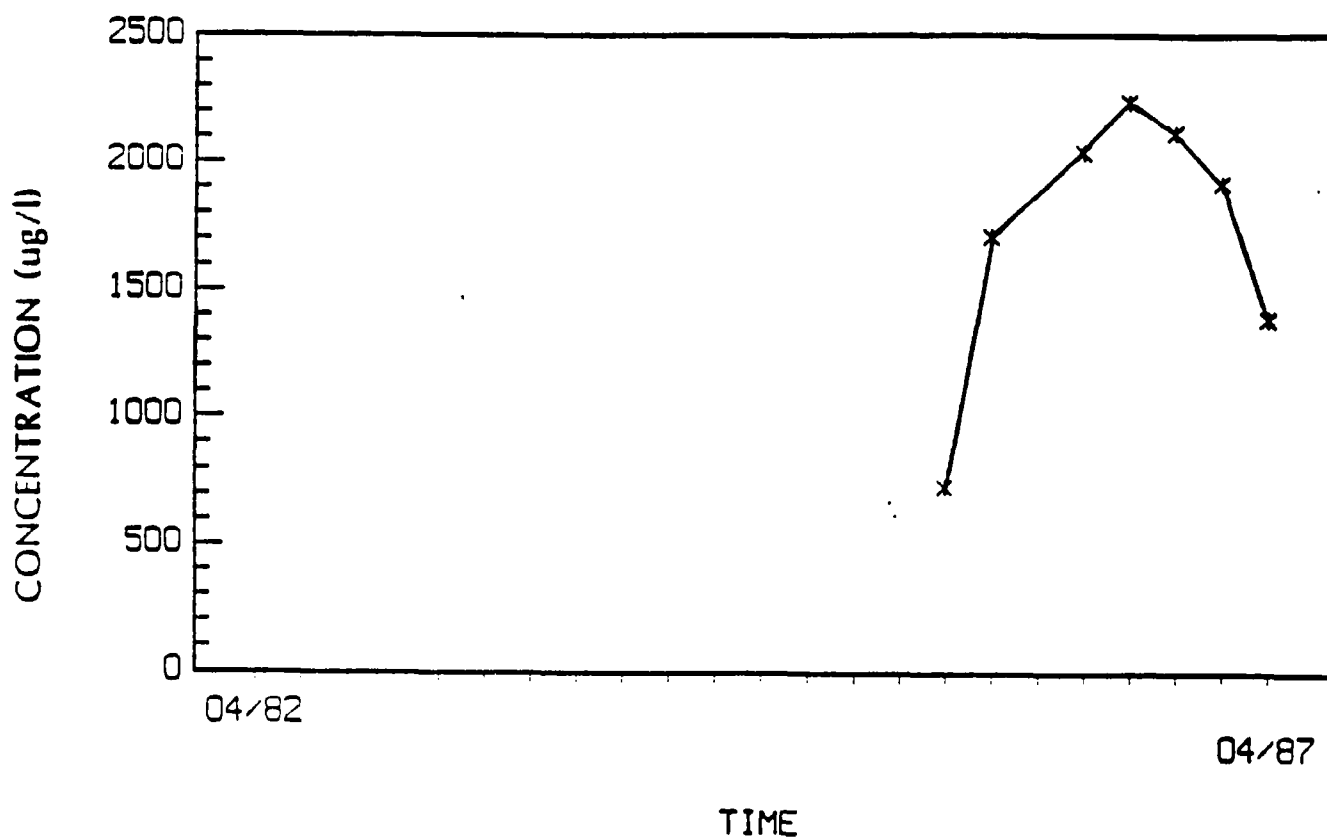
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-43

# MANGANESE AT G-123S



J NO. 873-2096		SCALE N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR
DRAWN LWK		DATE 7/28/87	
CHECKED		DWG. NO.	
Golder Associates			CHEMICAL WASTE MANAGEMENT, INC. FIGURE 9-44

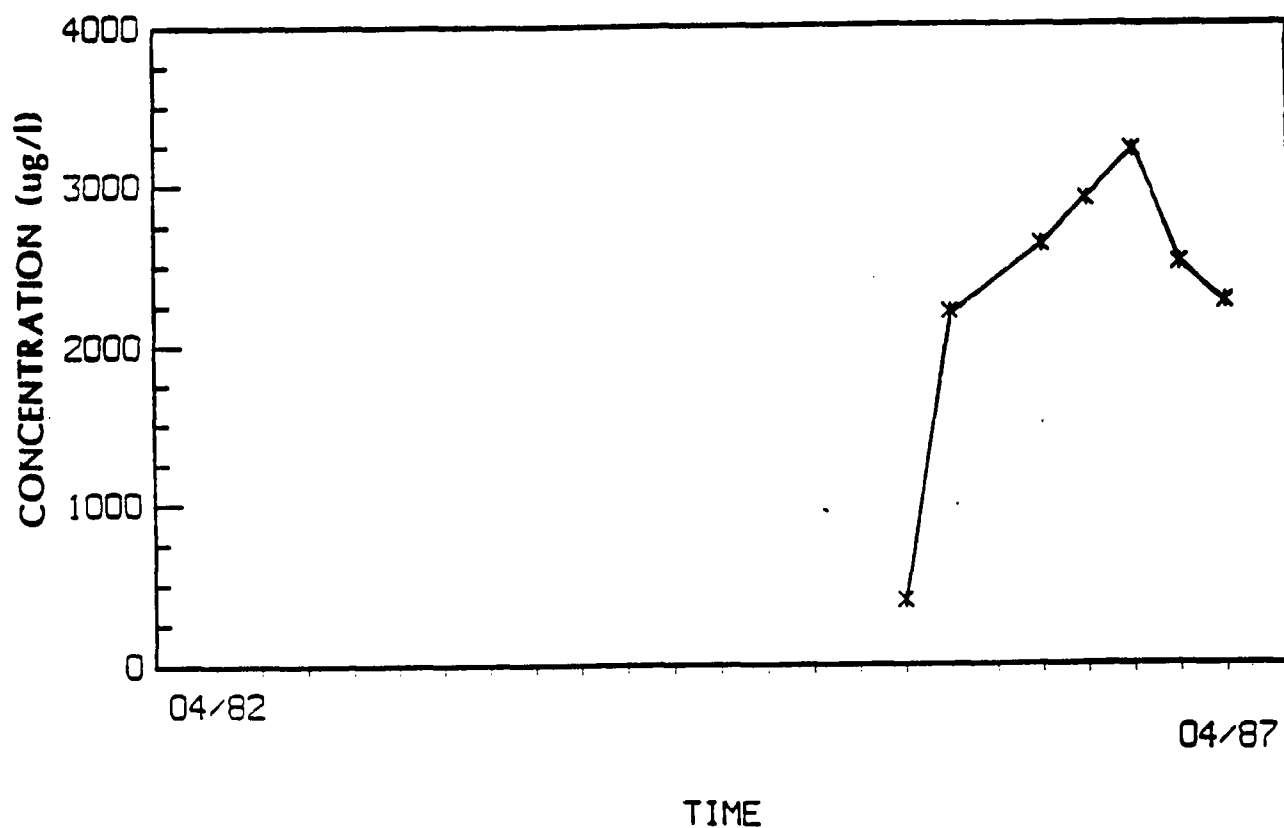
# MANGANESE AT G-124S



J NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-4

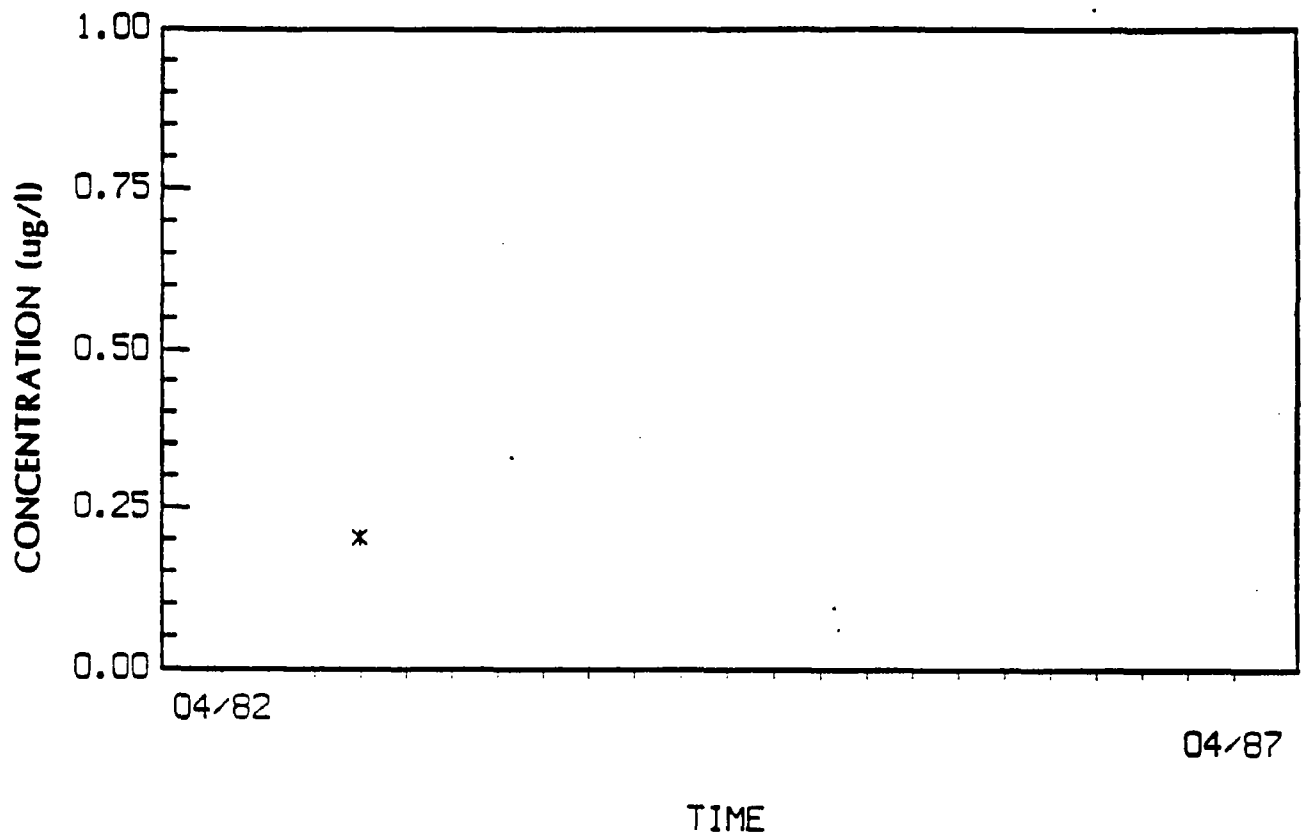


# MANGANESE AT G-1255



JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-4

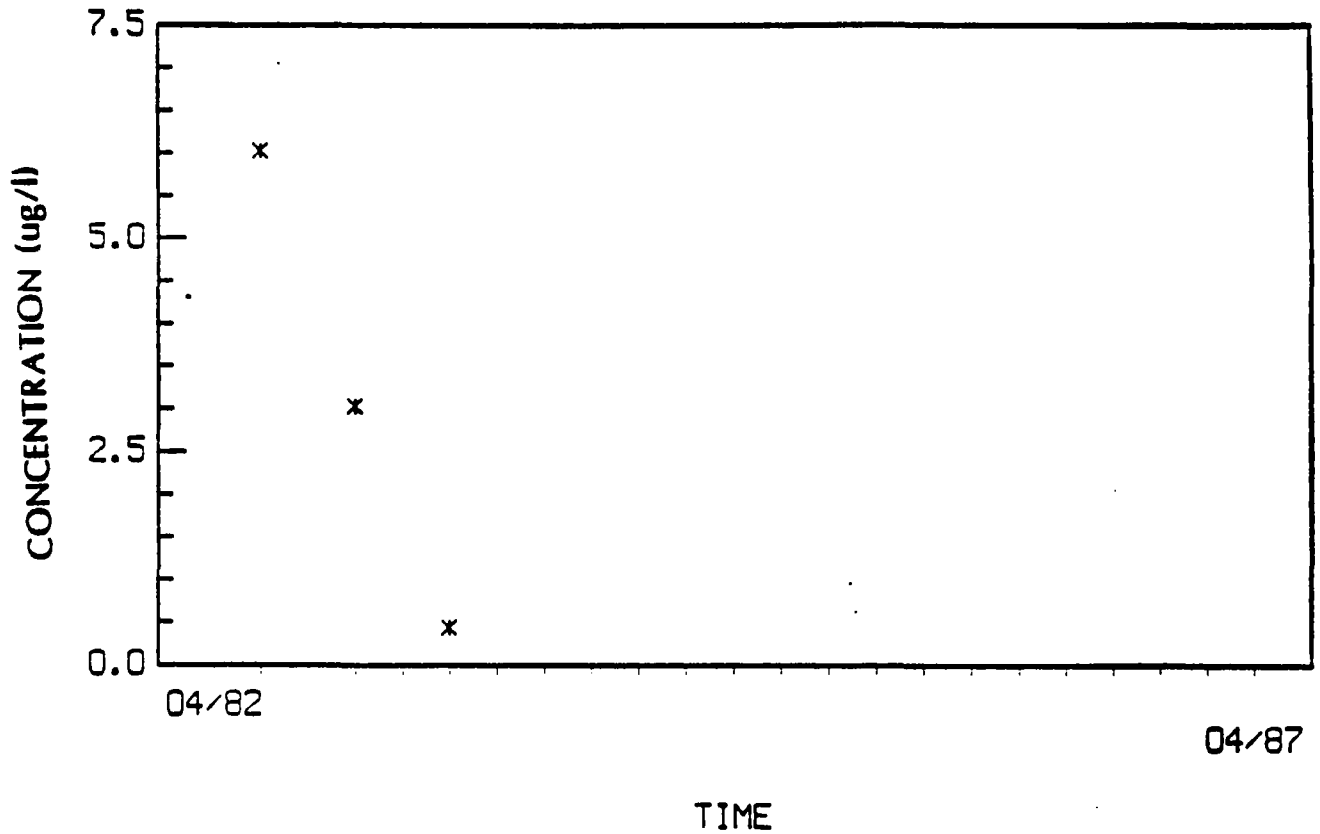
# MERCURY AT G-110



NOTE: DATA BELOW PMDL (8 ug/l)

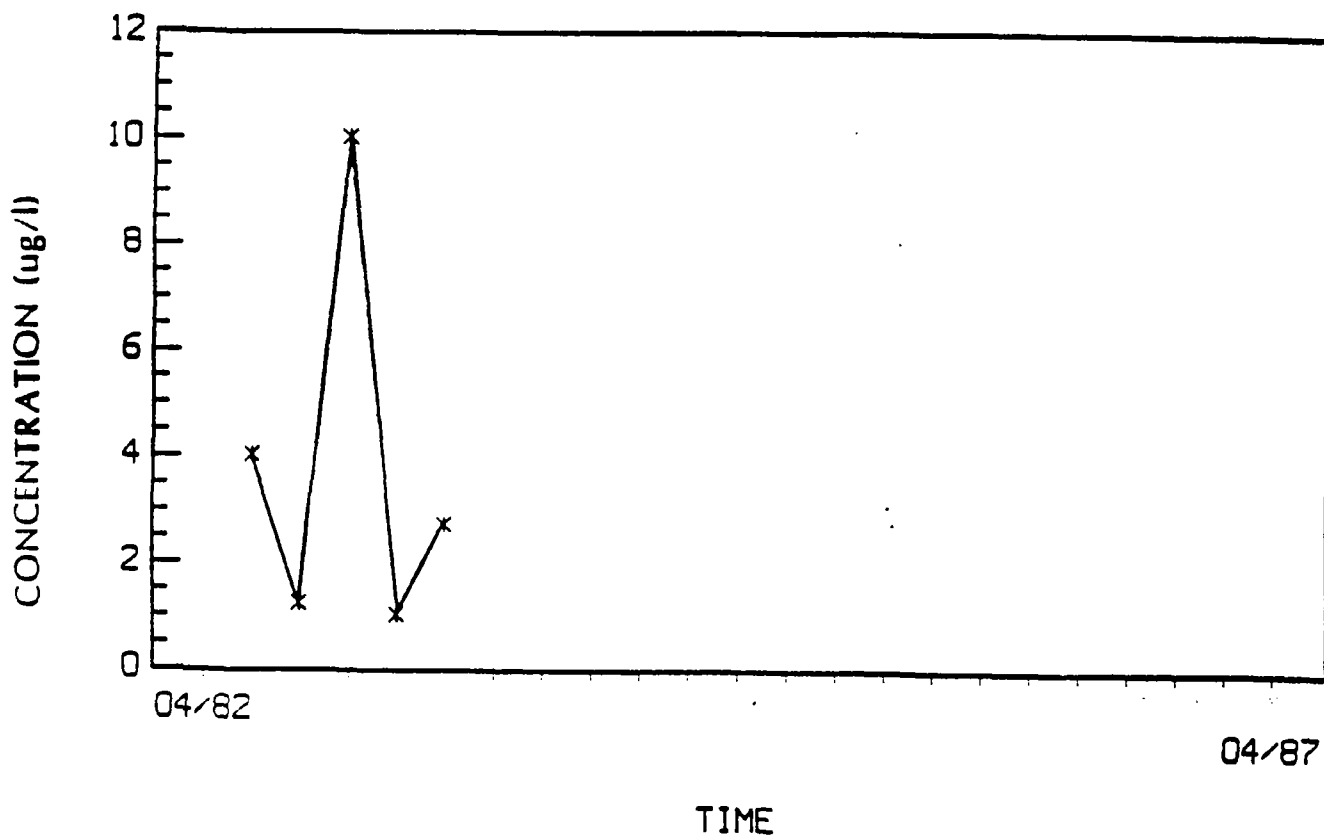
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG. NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 9-4

# MERCURY AT G-111A



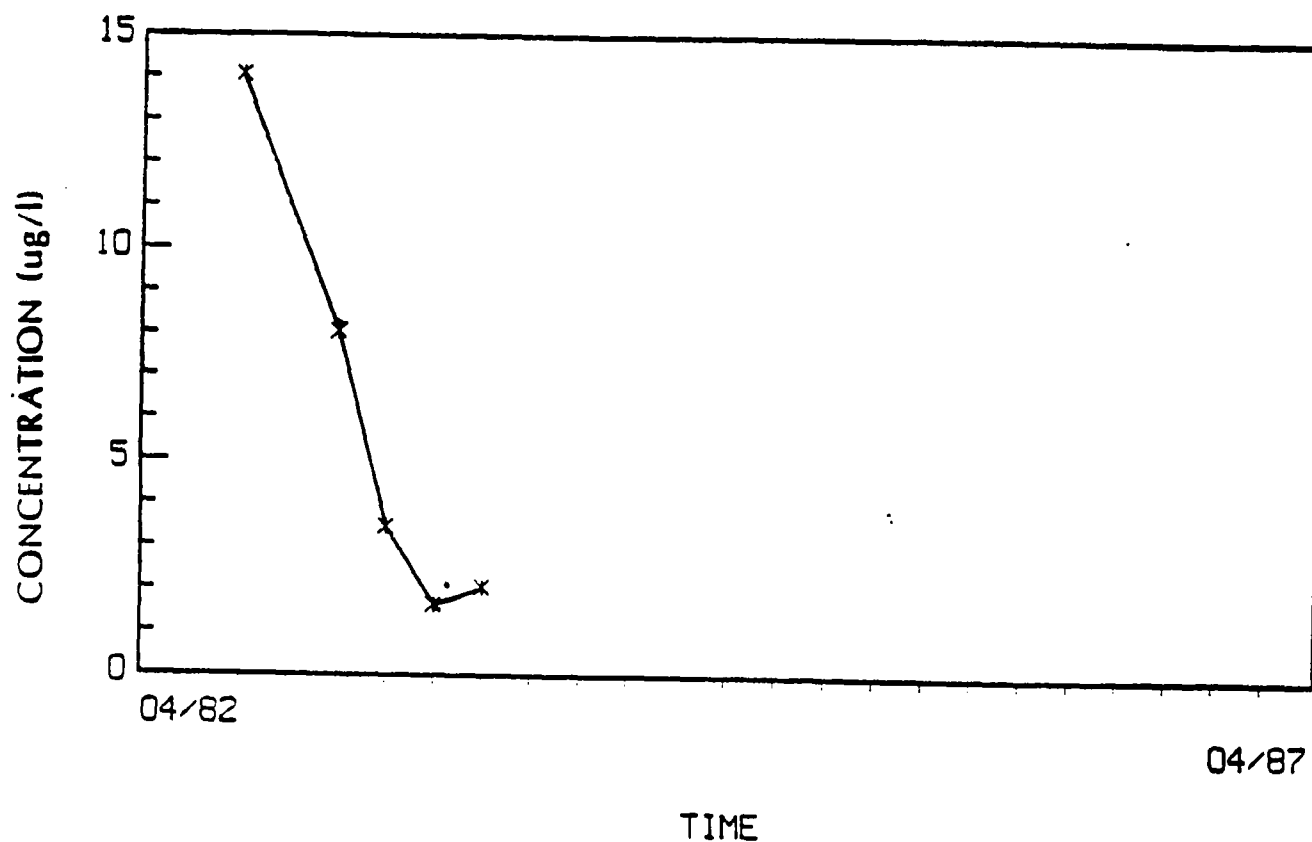
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK.	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-48

# MERCURY AT G-112B



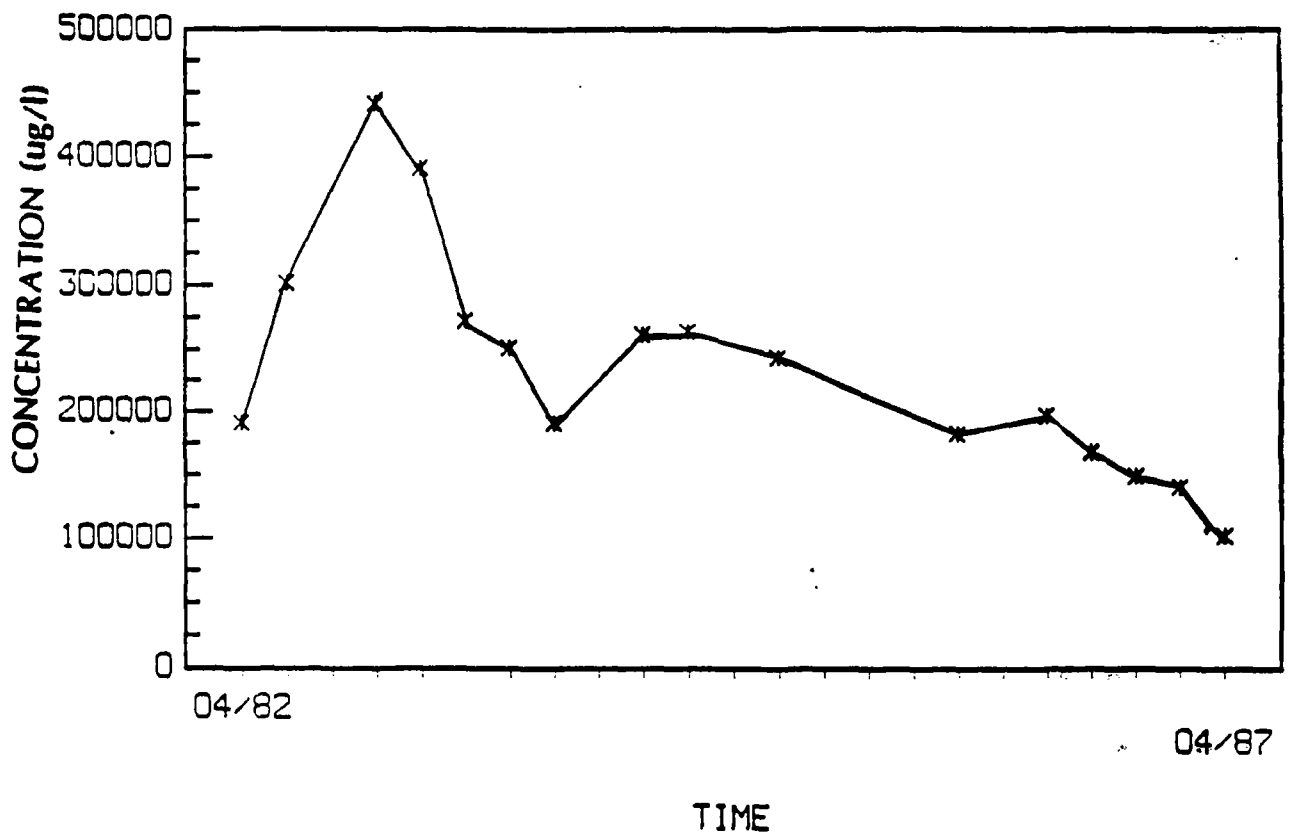
S NO. 873-2096		SCALE N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR
DRAWN LWK		DATE 7/28/87	
CHECKED		DWG. NO.	
Golder Associates			CHEMICAL WASTE MANAGEMENT, INC. FIGURE 9-49

# MERCURY AT G-113A



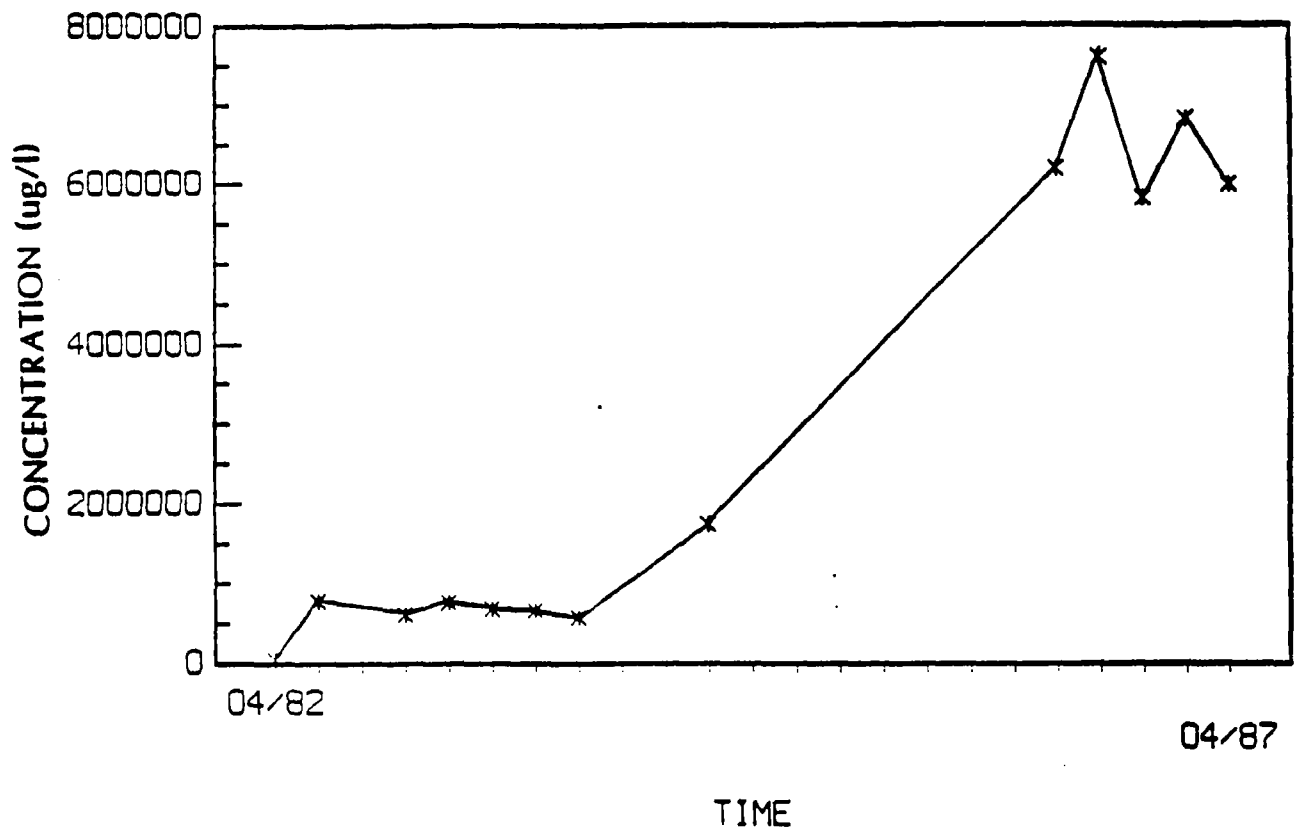
JB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-50

# SODIUM AT G-110



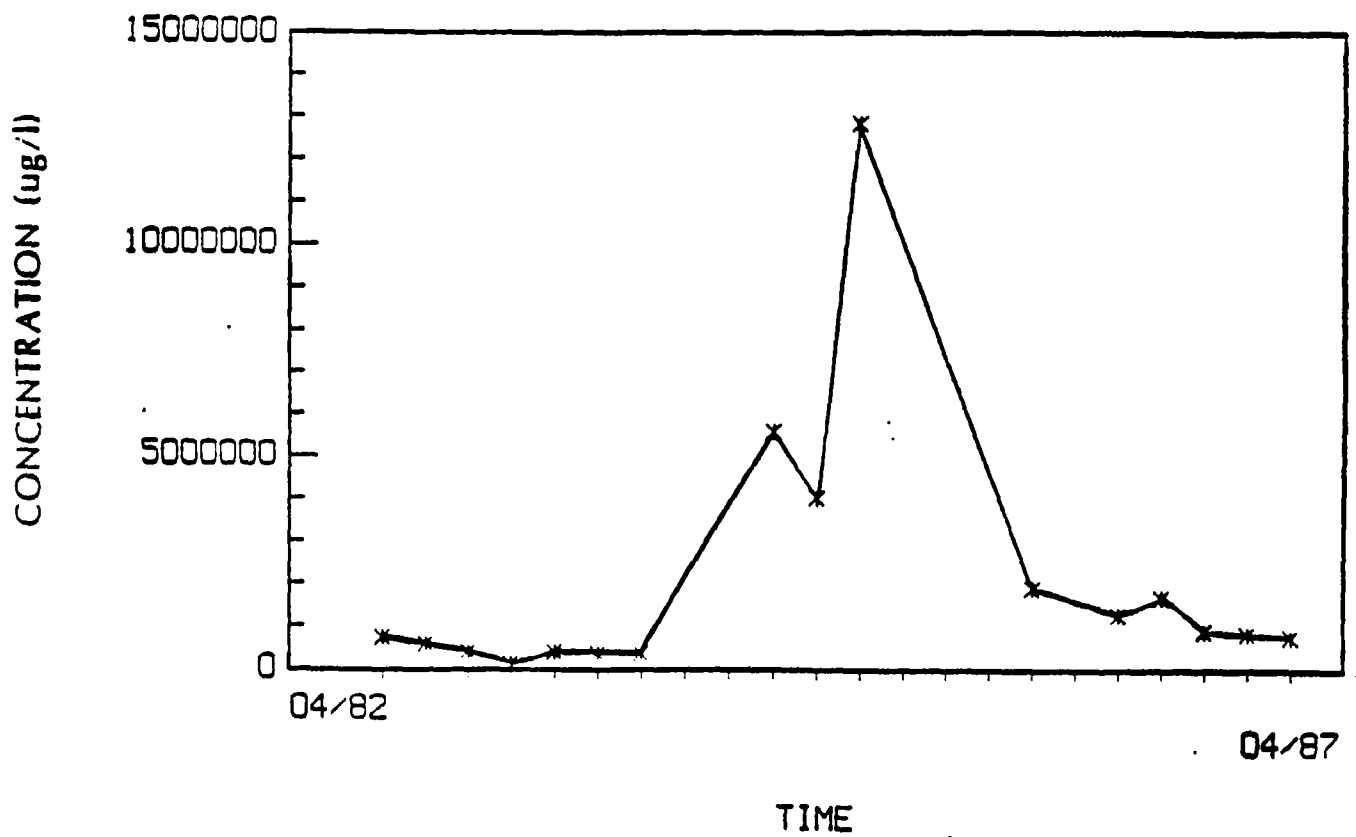
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-51

# SODIUM AT G-111A



JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-52

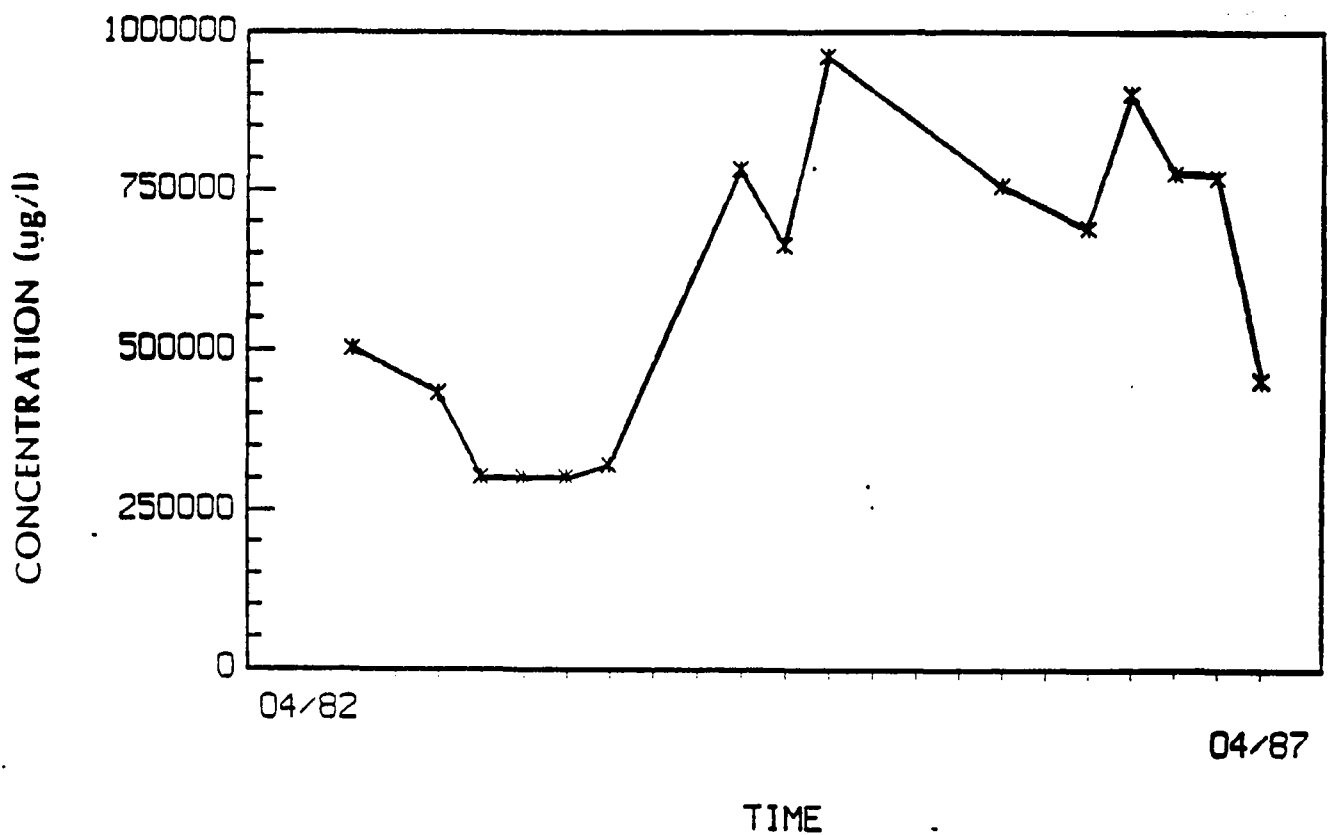
# SODIUM AT G-112B



JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-53

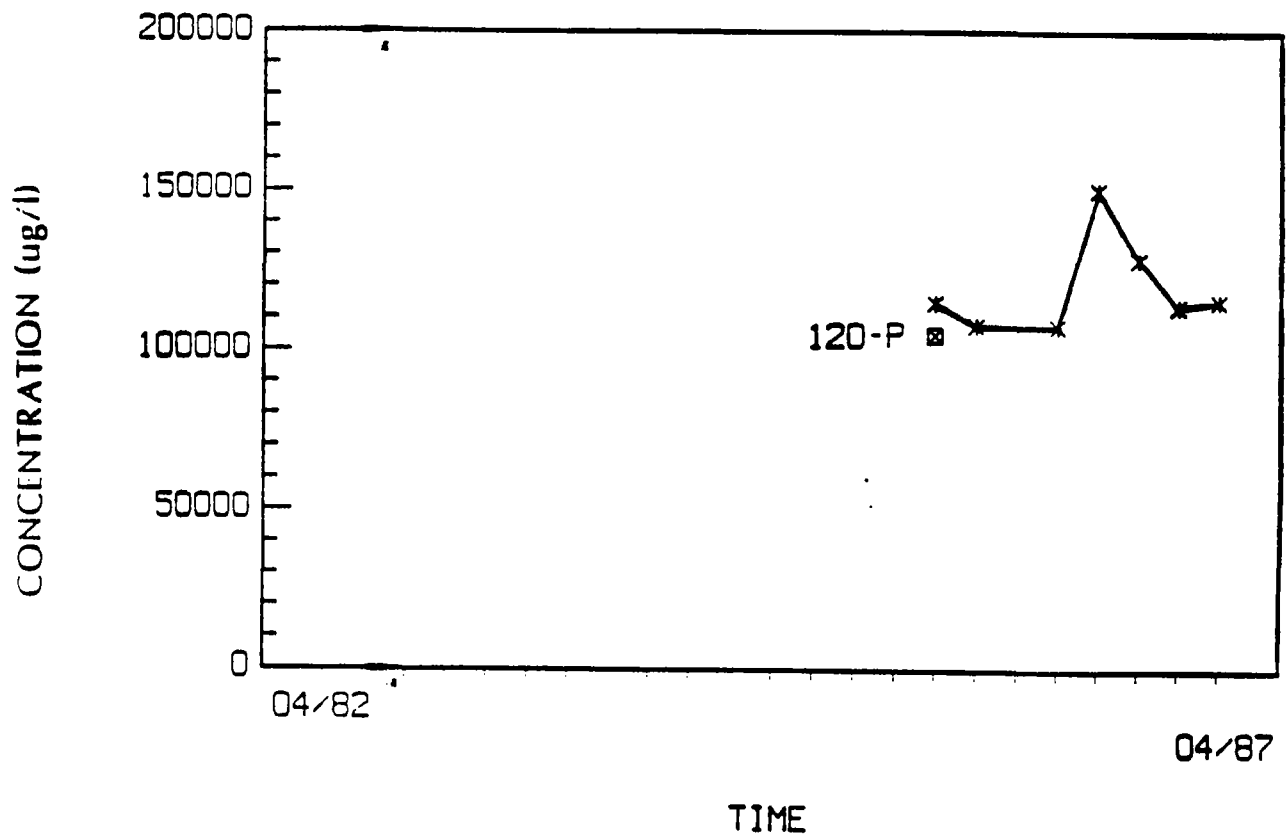


# SODIUM AT G-113A



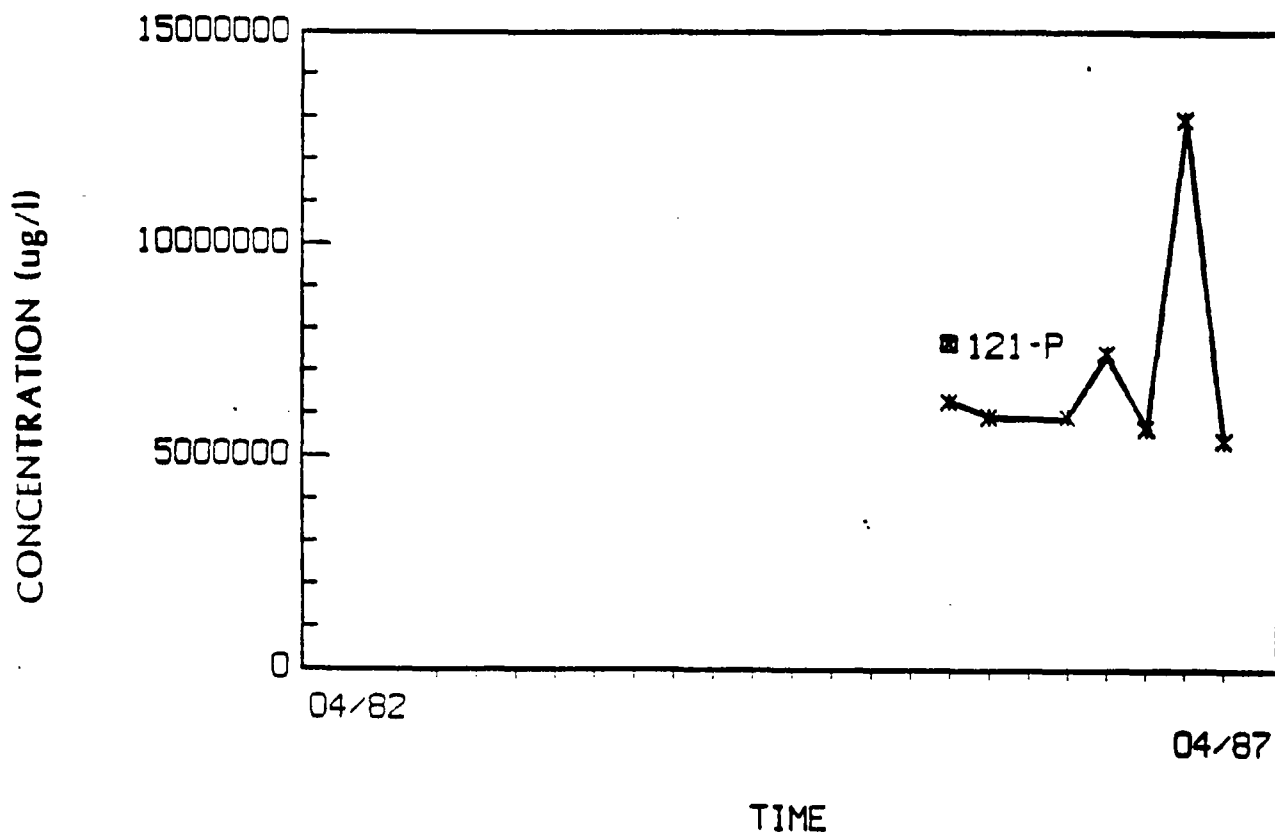
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-54

# SODIUM AT G-120S



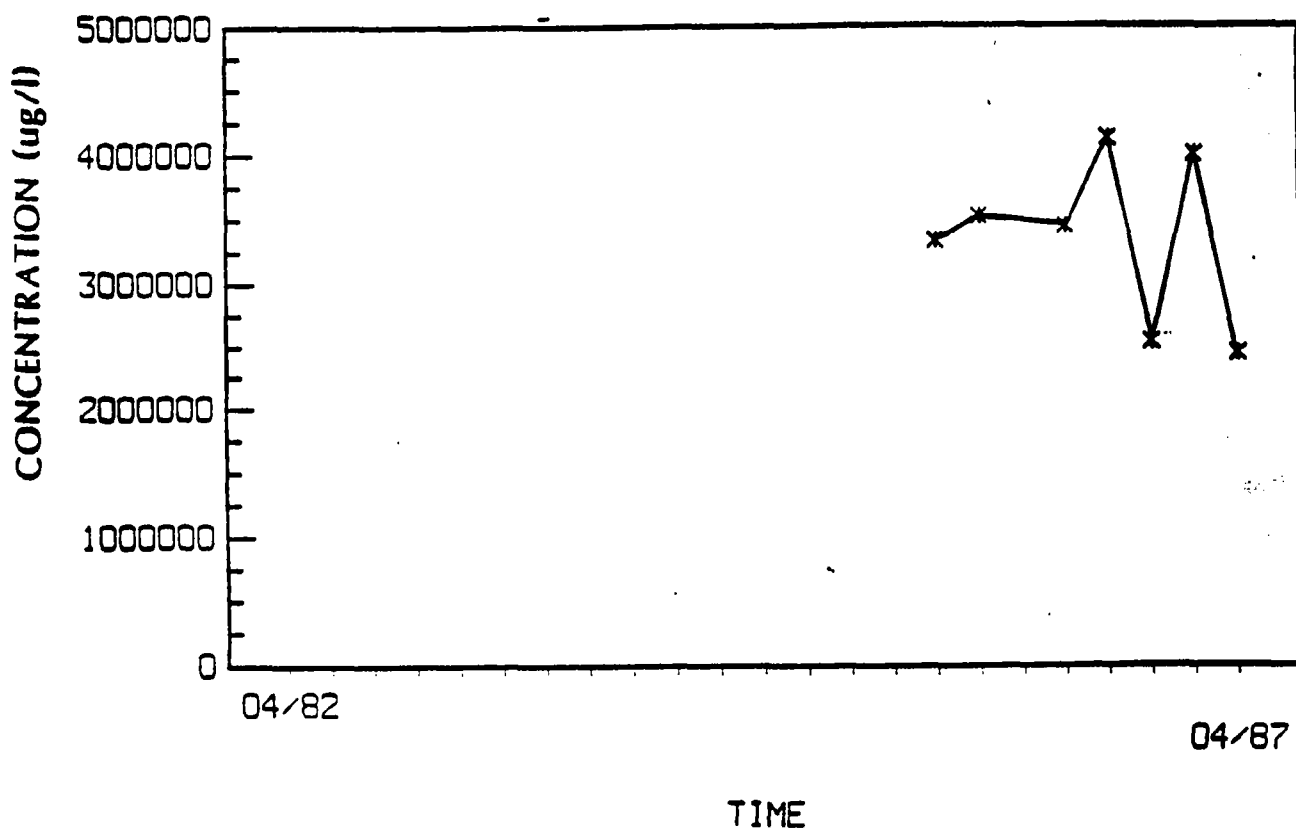
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	FIGURE 9-5
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	

# SODIUM AT G-121S



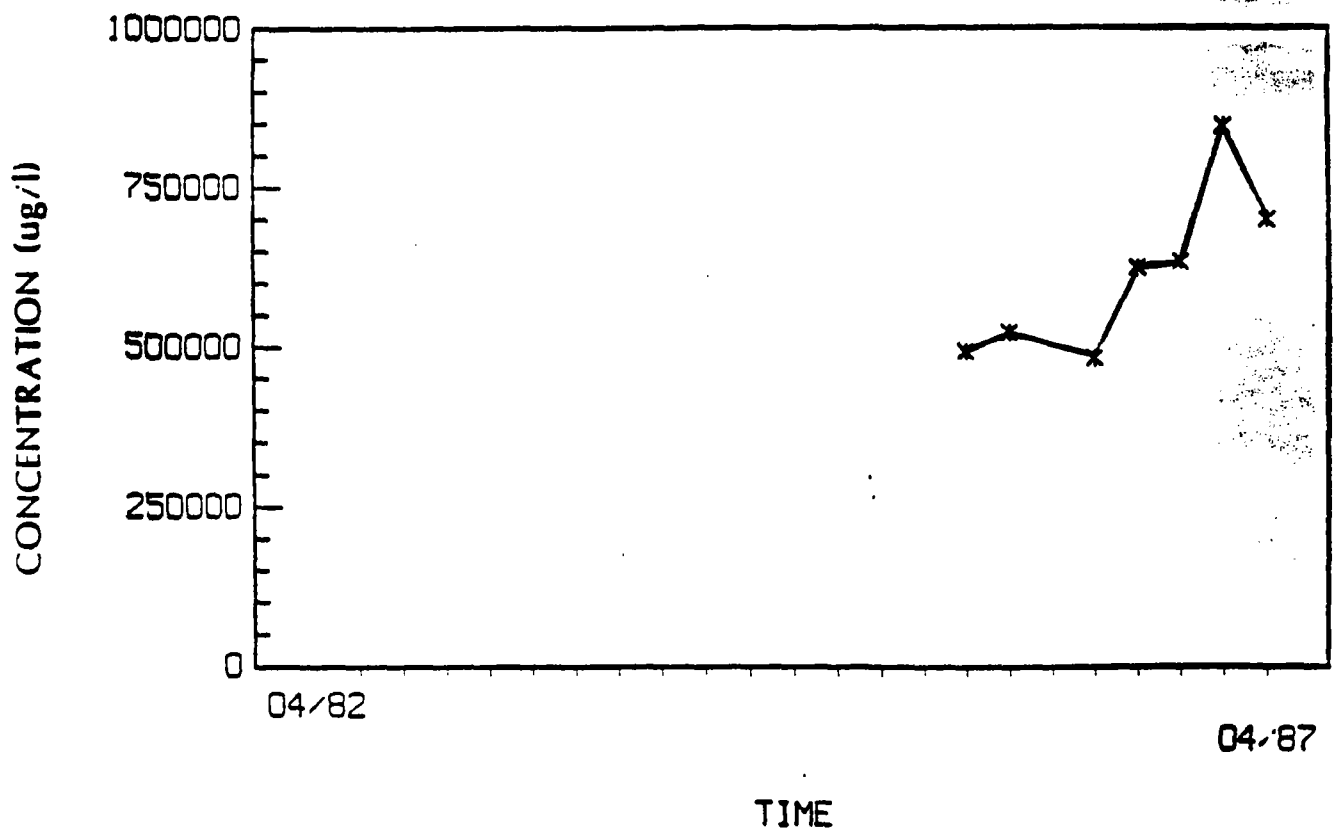
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-5

# SODIUM AT G-122S



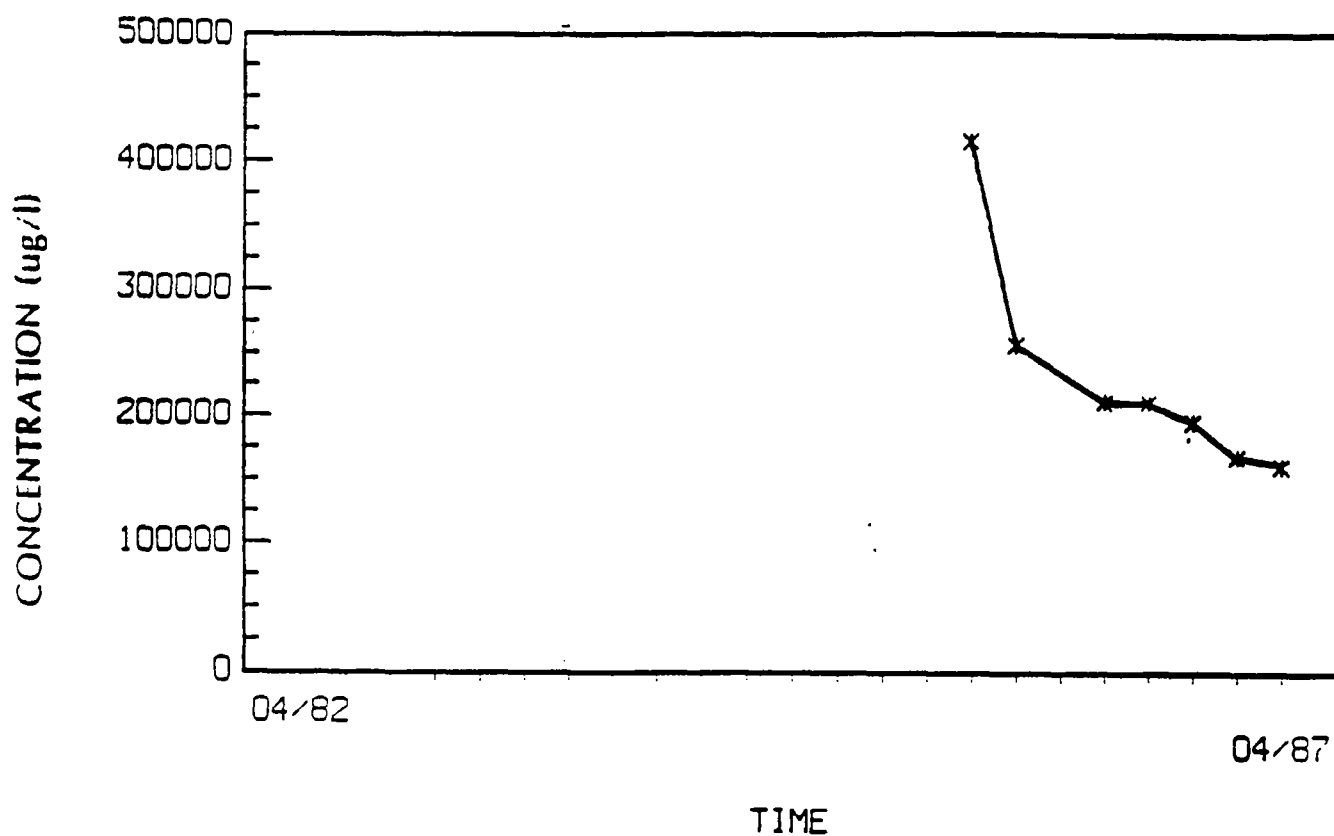
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-57

# SODIUM AT G-123S



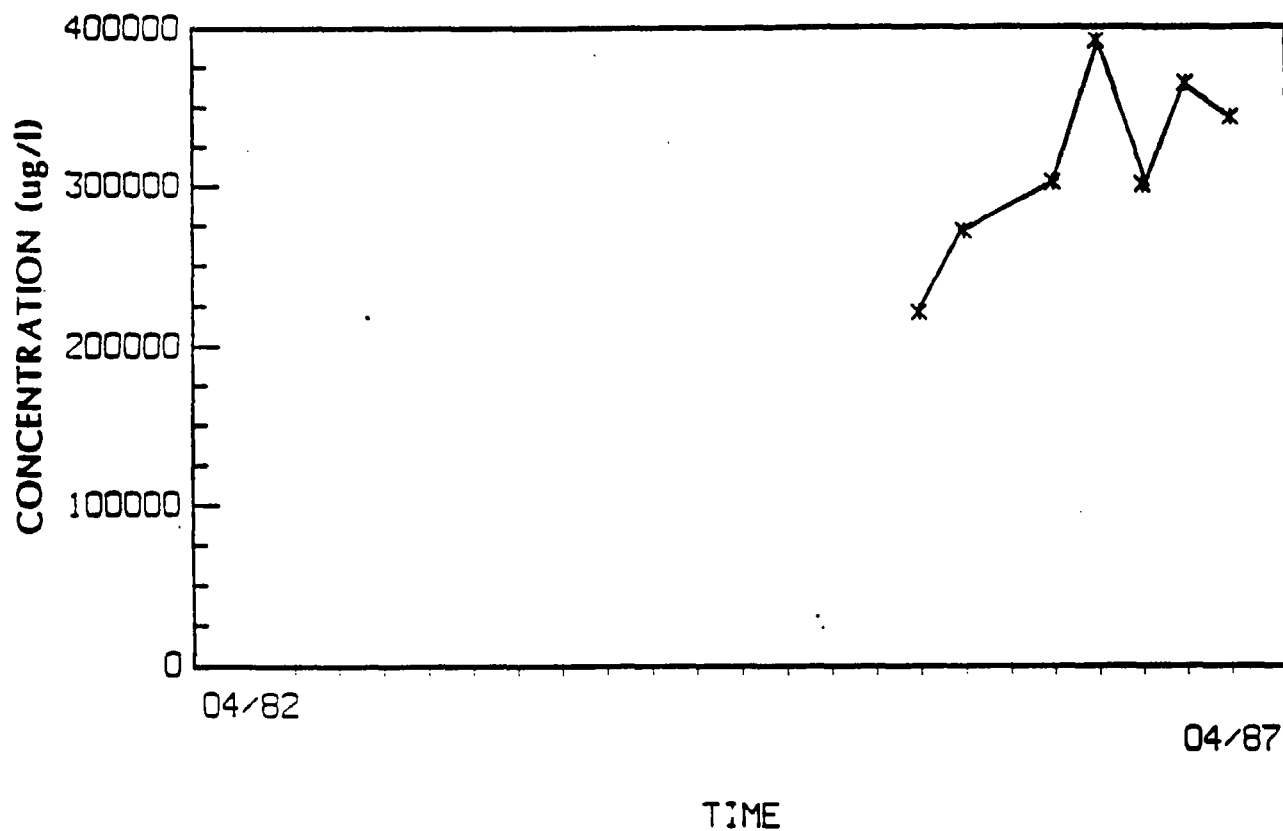
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG. NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 9-E

# SODIUM AT G-124S



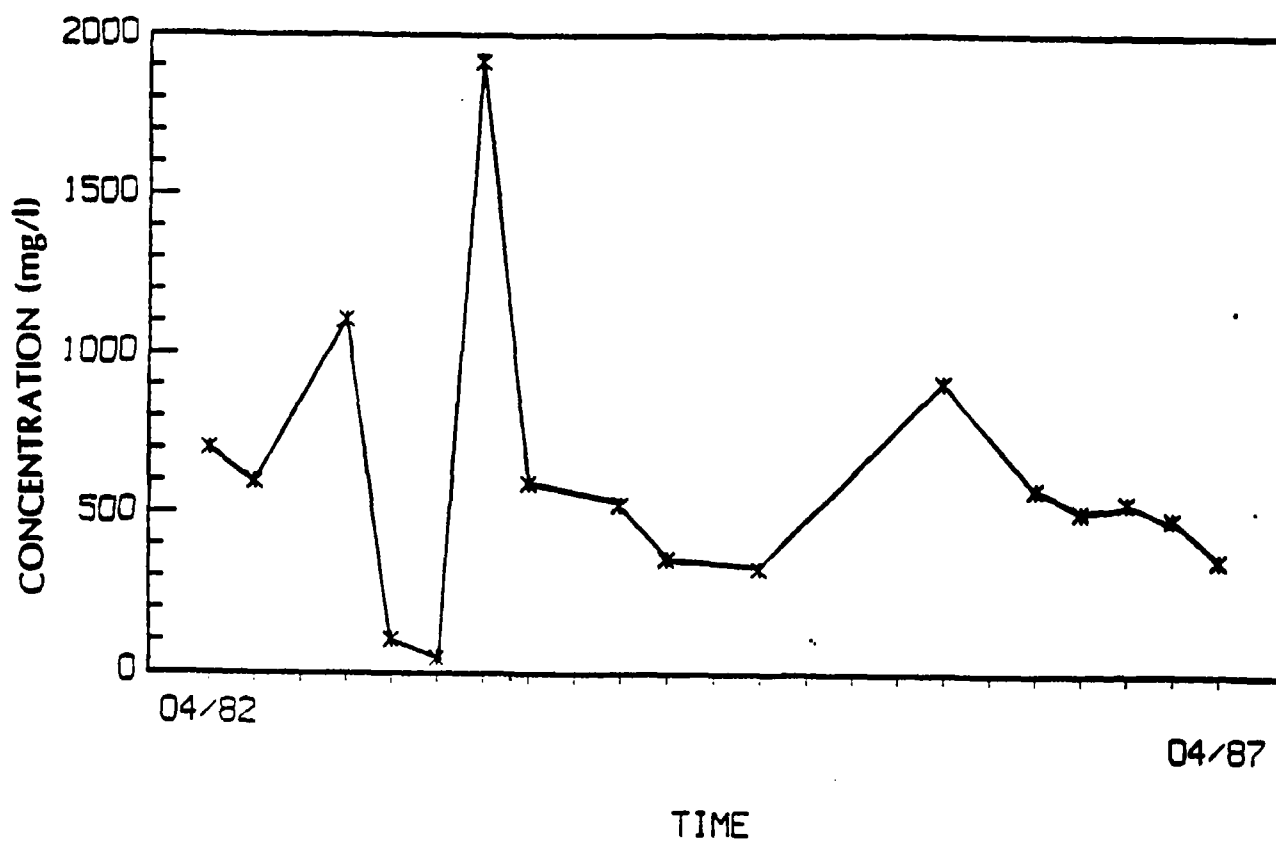
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-5

# SODIUM AT G-125S



JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG. NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 9-6

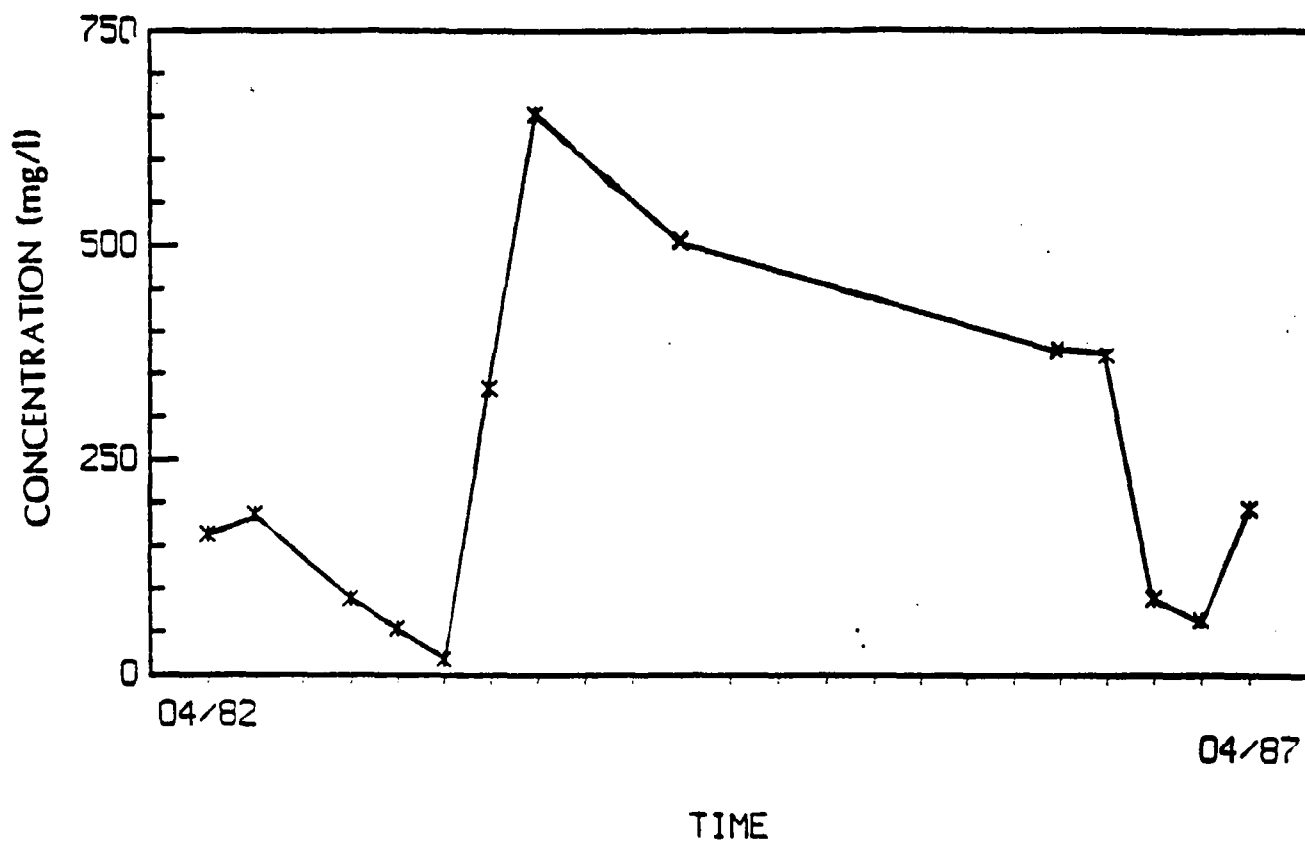
# SULFATE AS SO<sub>4</sub> AT G-110



JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-6

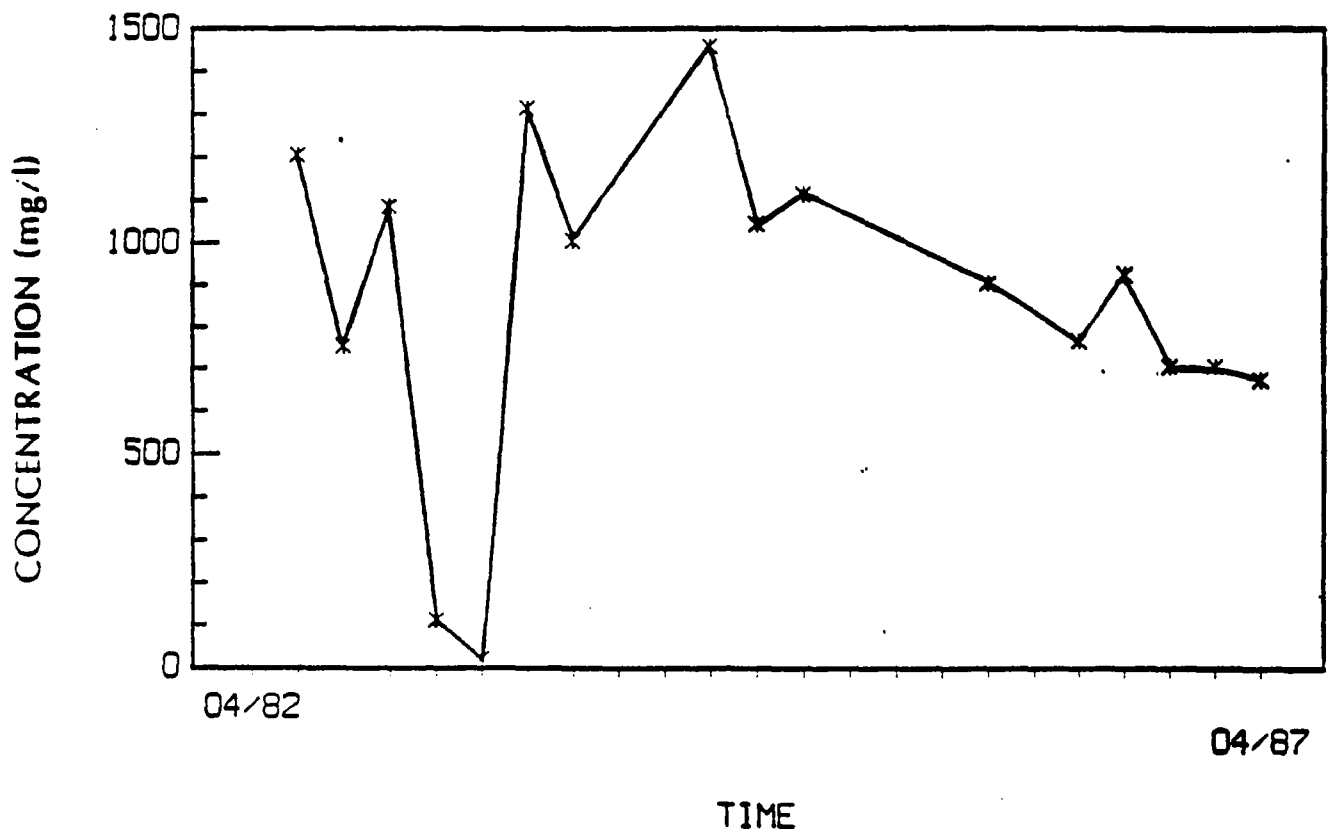


# SULFATE AS SO<sub>4</sub> AT G-111A



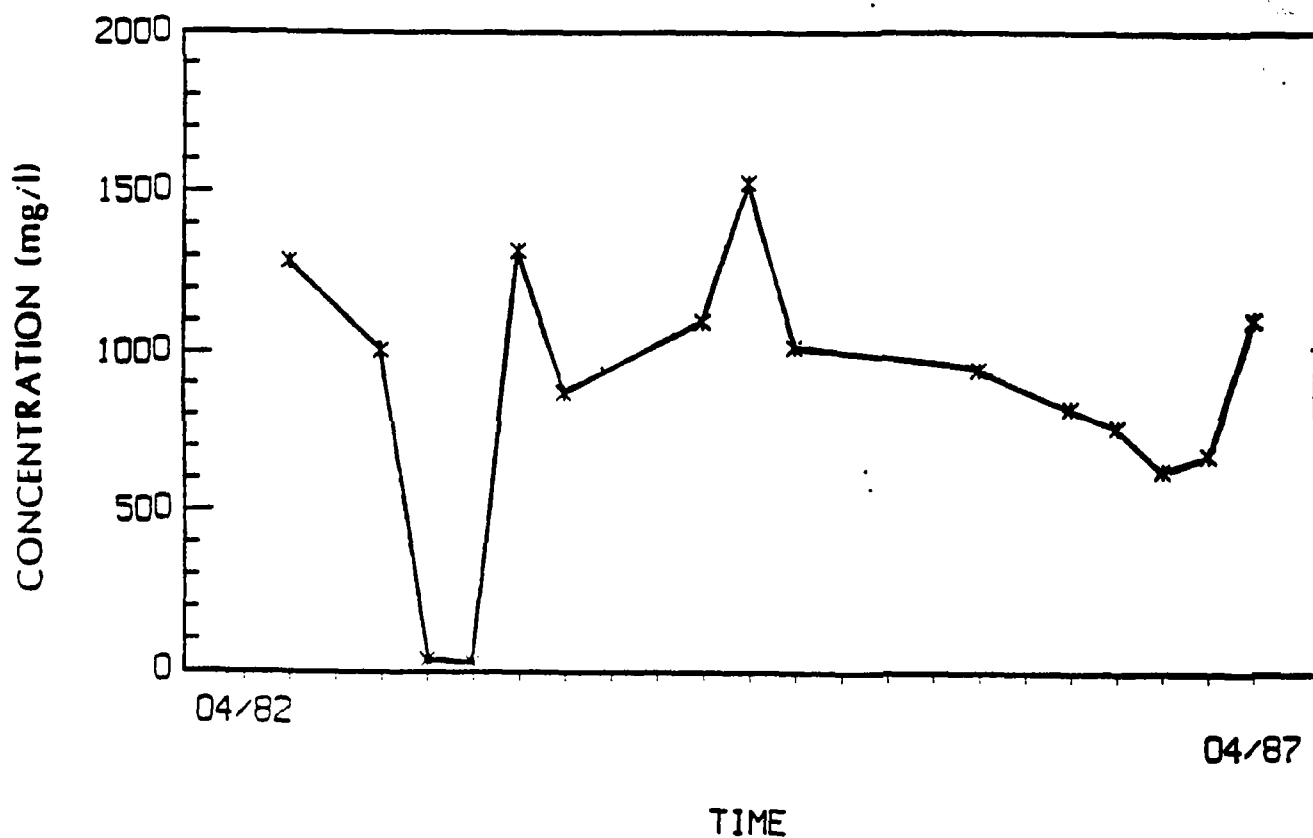
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-6

# SULFATE AS SO4 AT G-112B



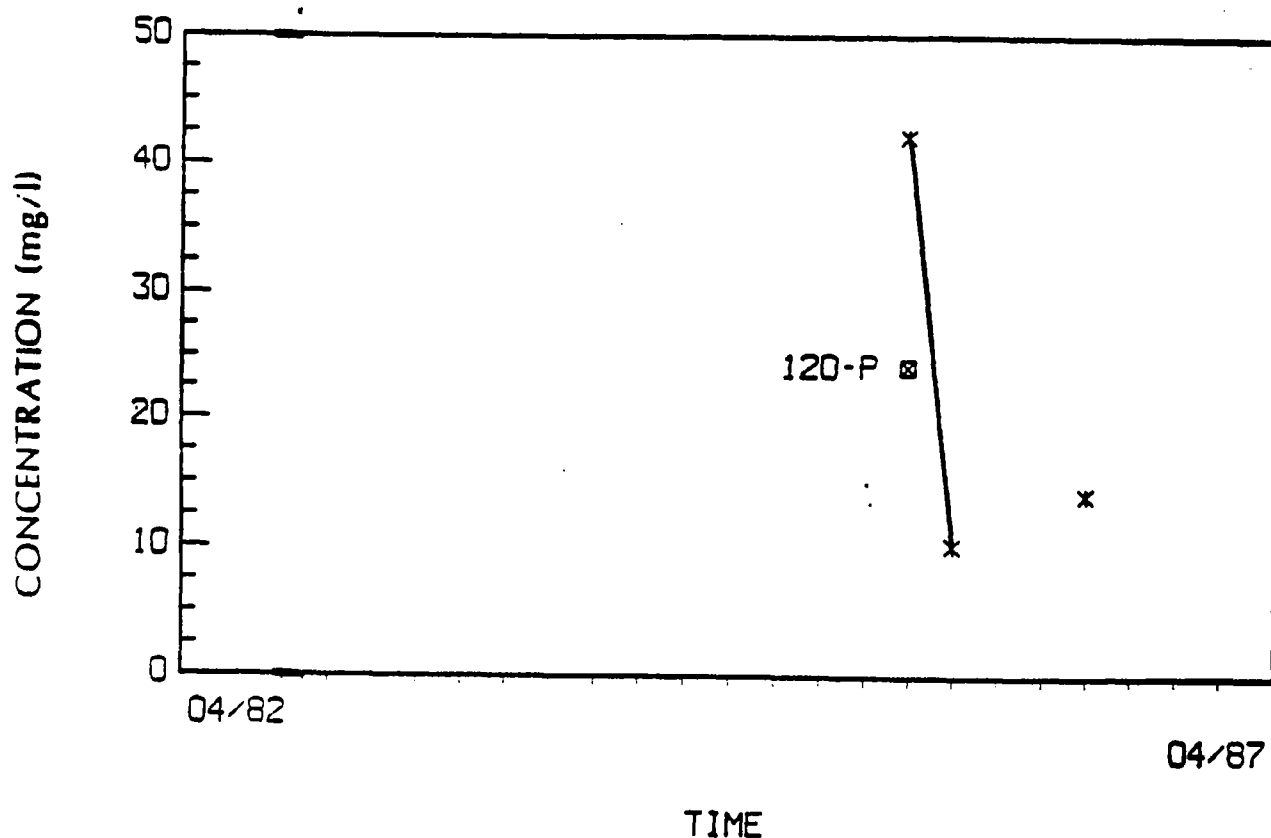
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-63

# SULFATE AS SO<sub>4</sub> AT G-113A



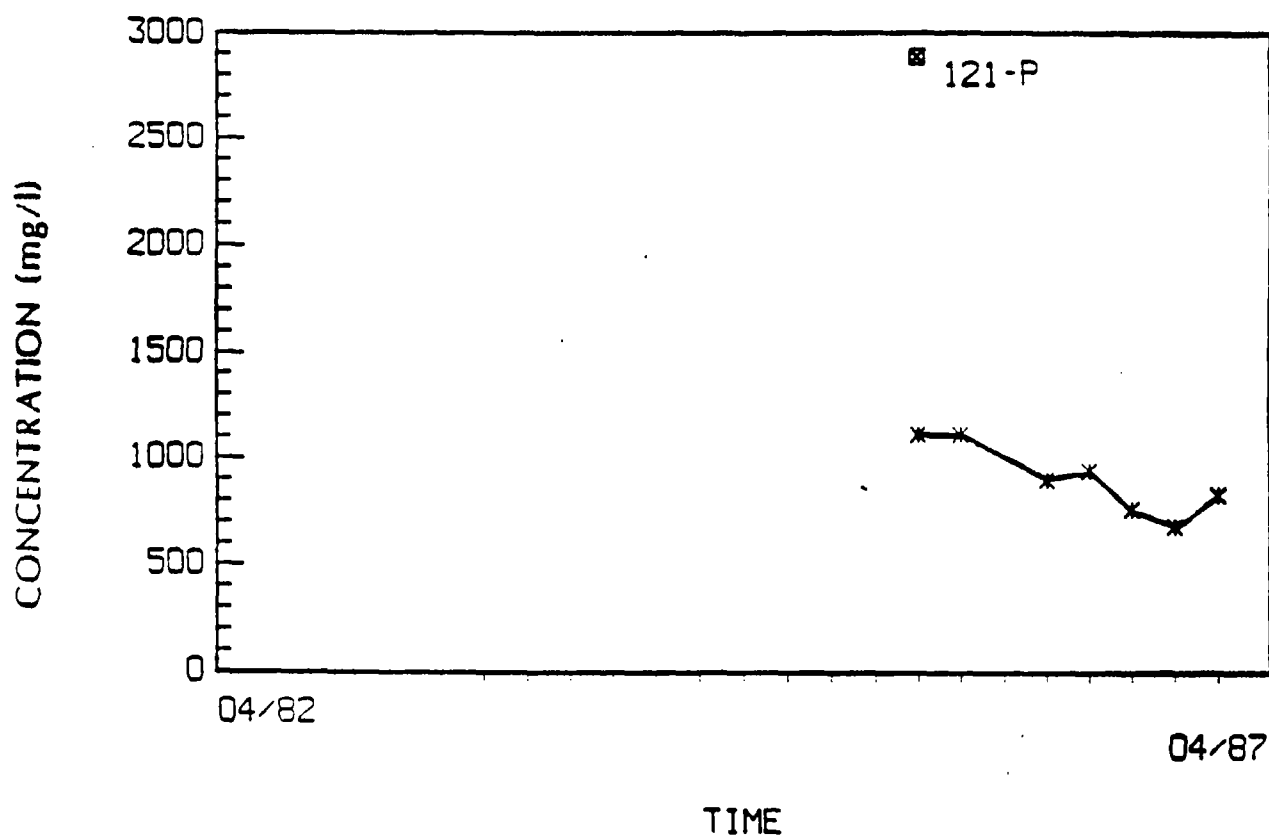
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-6

# SULFATE AS SO<sub>4</sub> AT G-120S



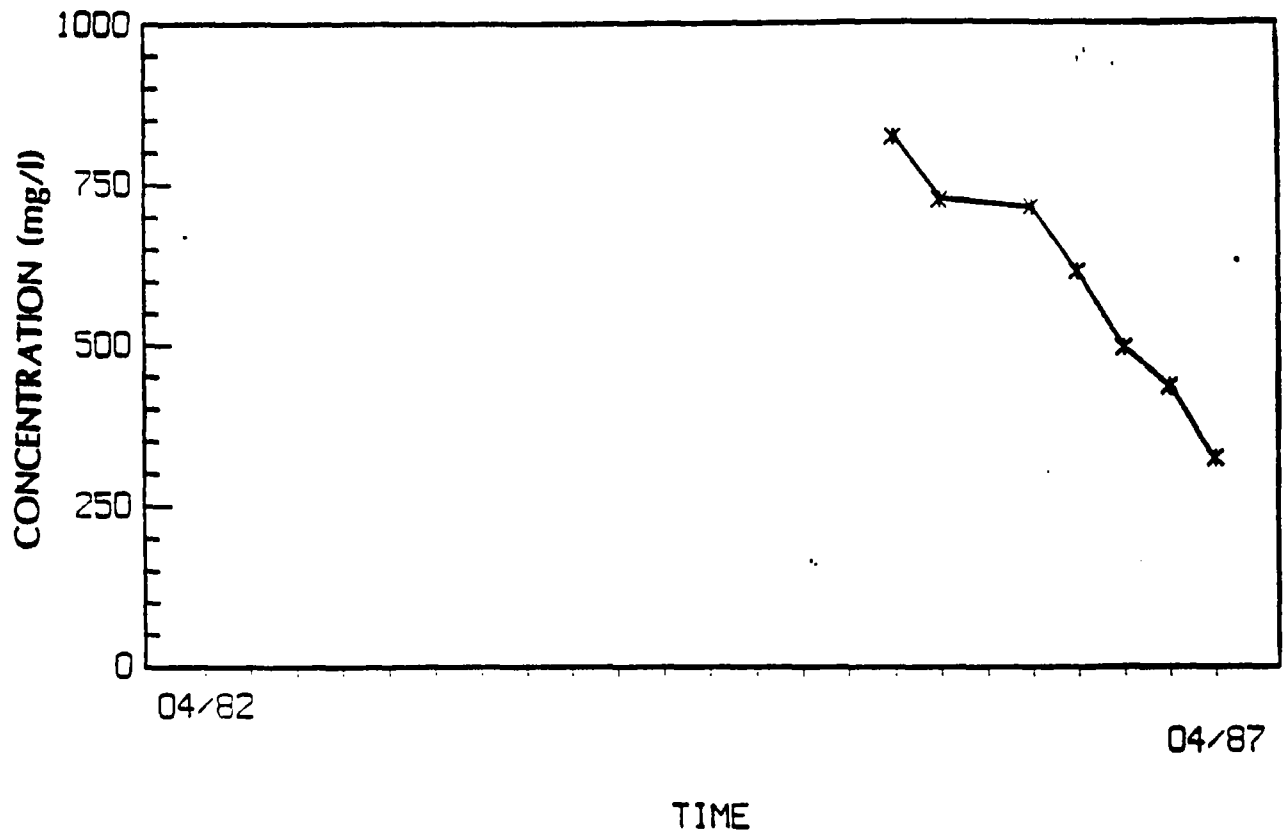
OS NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-6

# SULFATE AS SO<sub>4</sub> AT G-121S



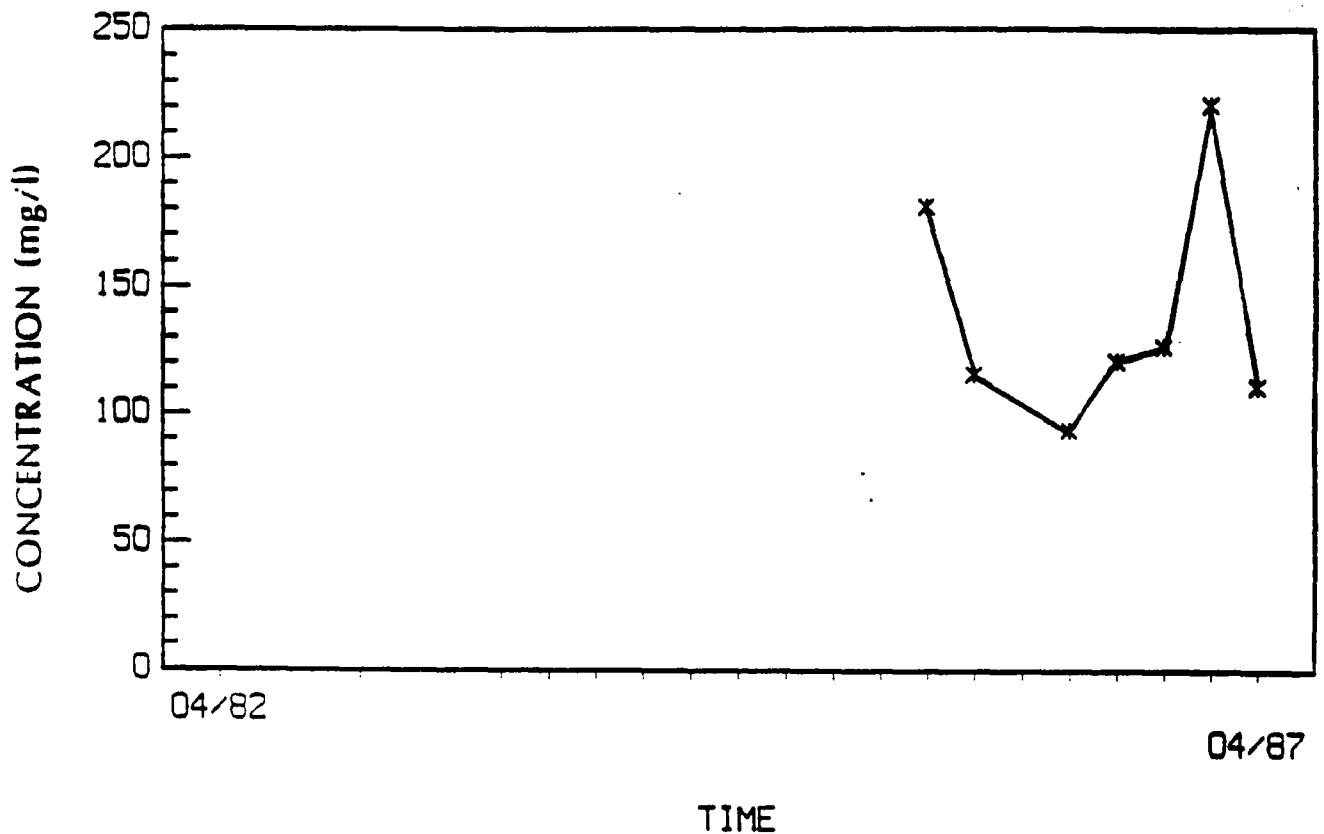
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG. NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 9-6

# SULFATE AS SO4 AT G-122S



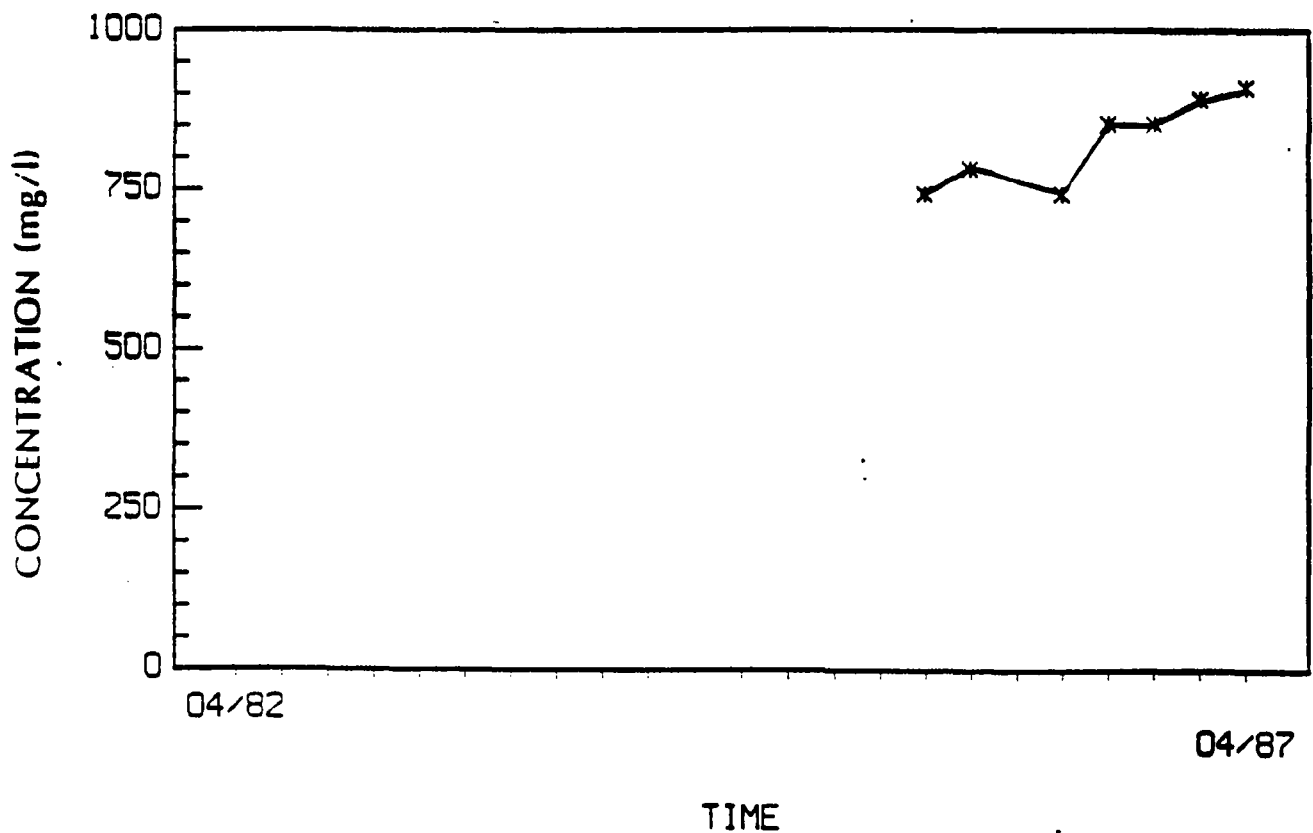
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG. NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 9-6

# SULFATE AS SO4 AT G-123S



OS NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-6

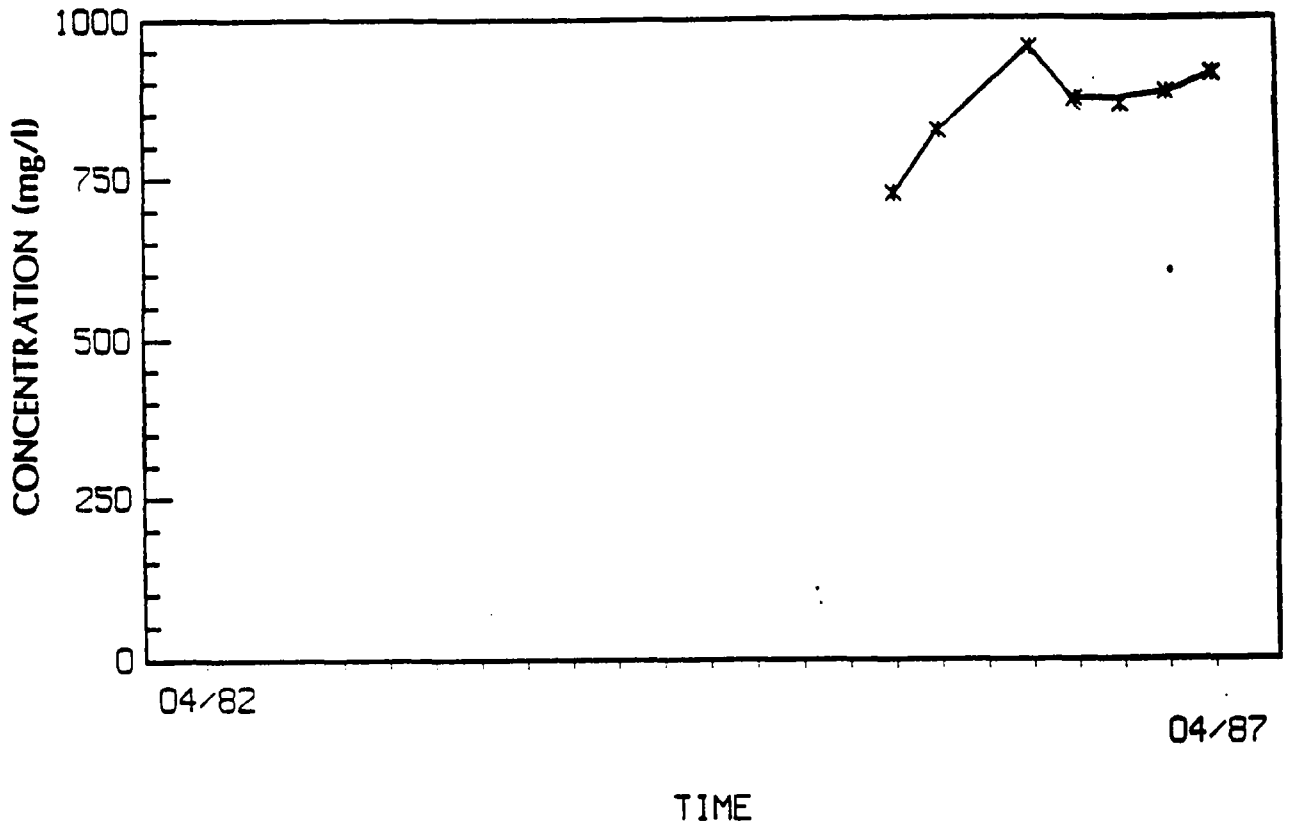
# SULFATE AS SO<sub>4</sub> AT G-124S



JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-6

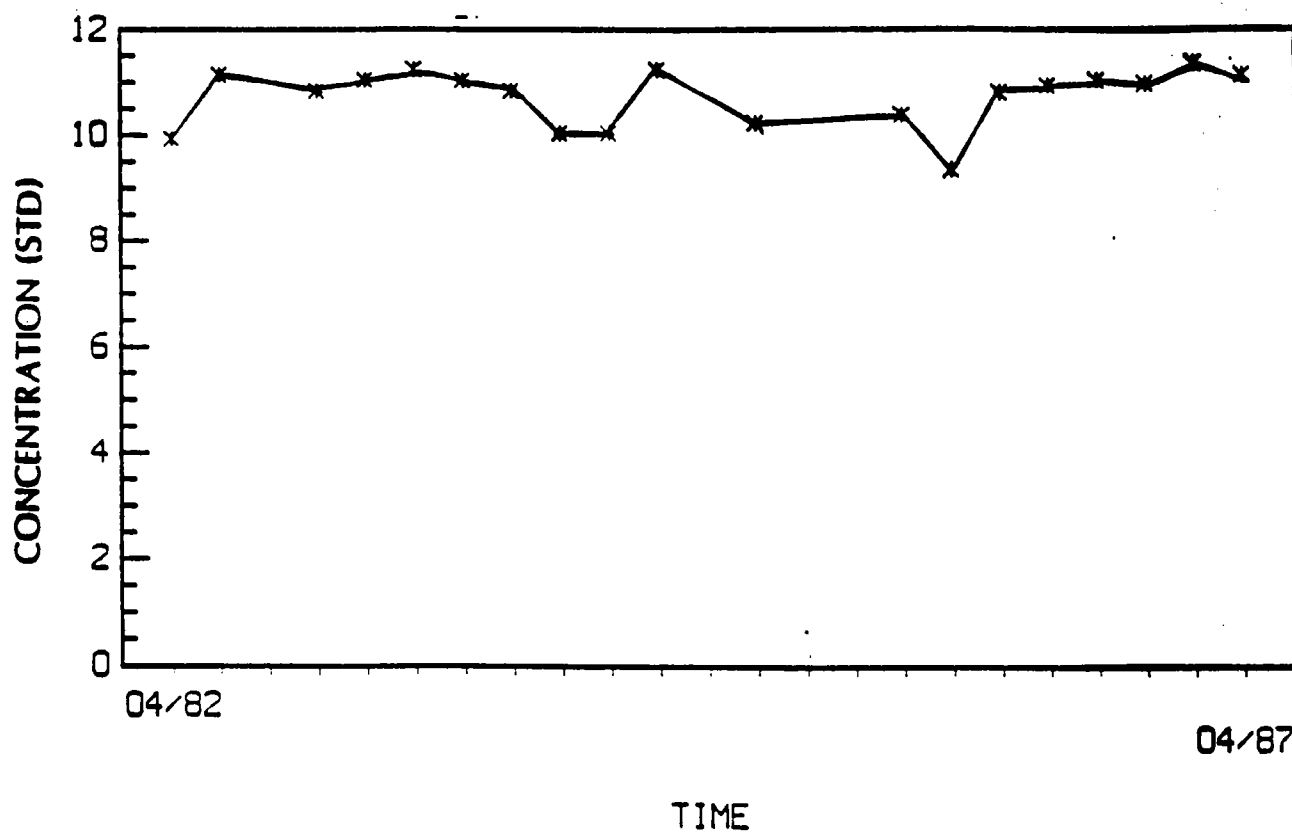


# SULFATE AS SO<sub>4</sub> AT G-125S



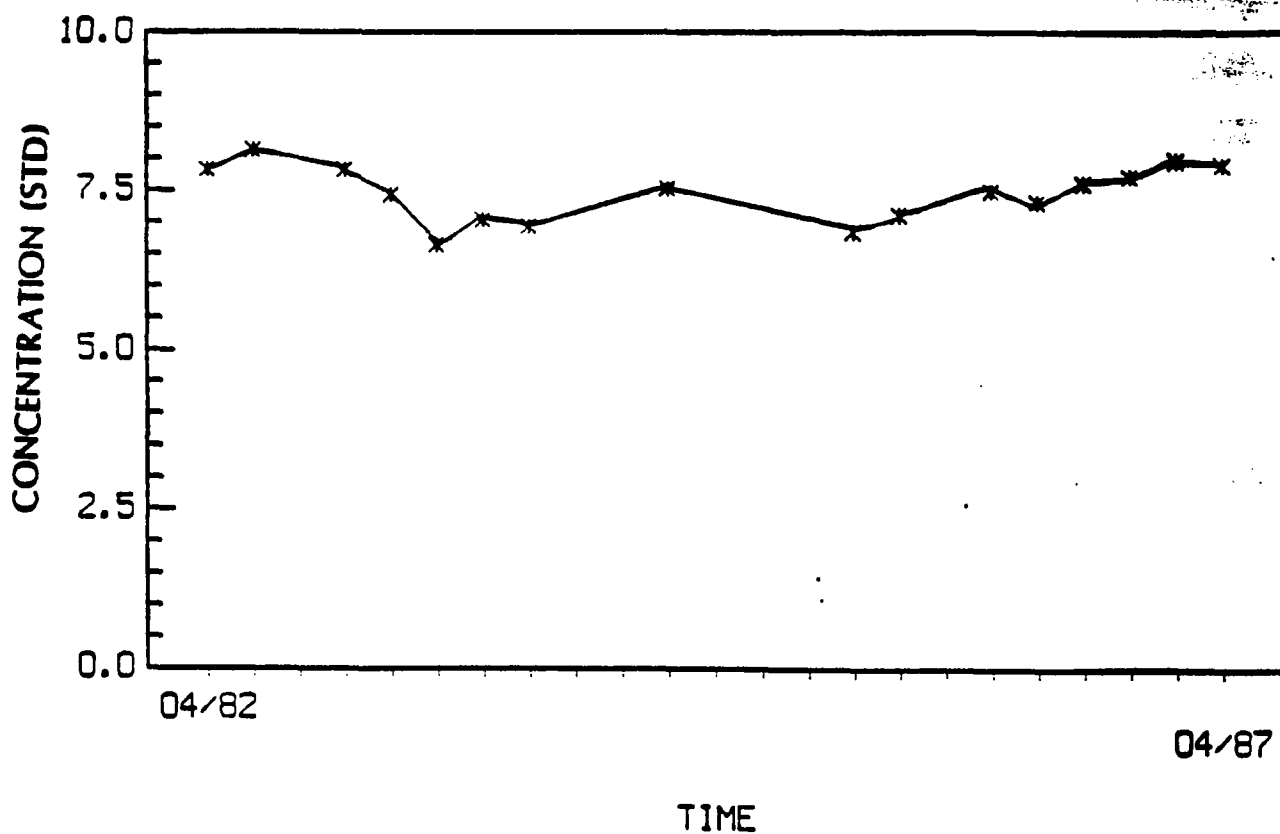
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-70

PH AT G-110



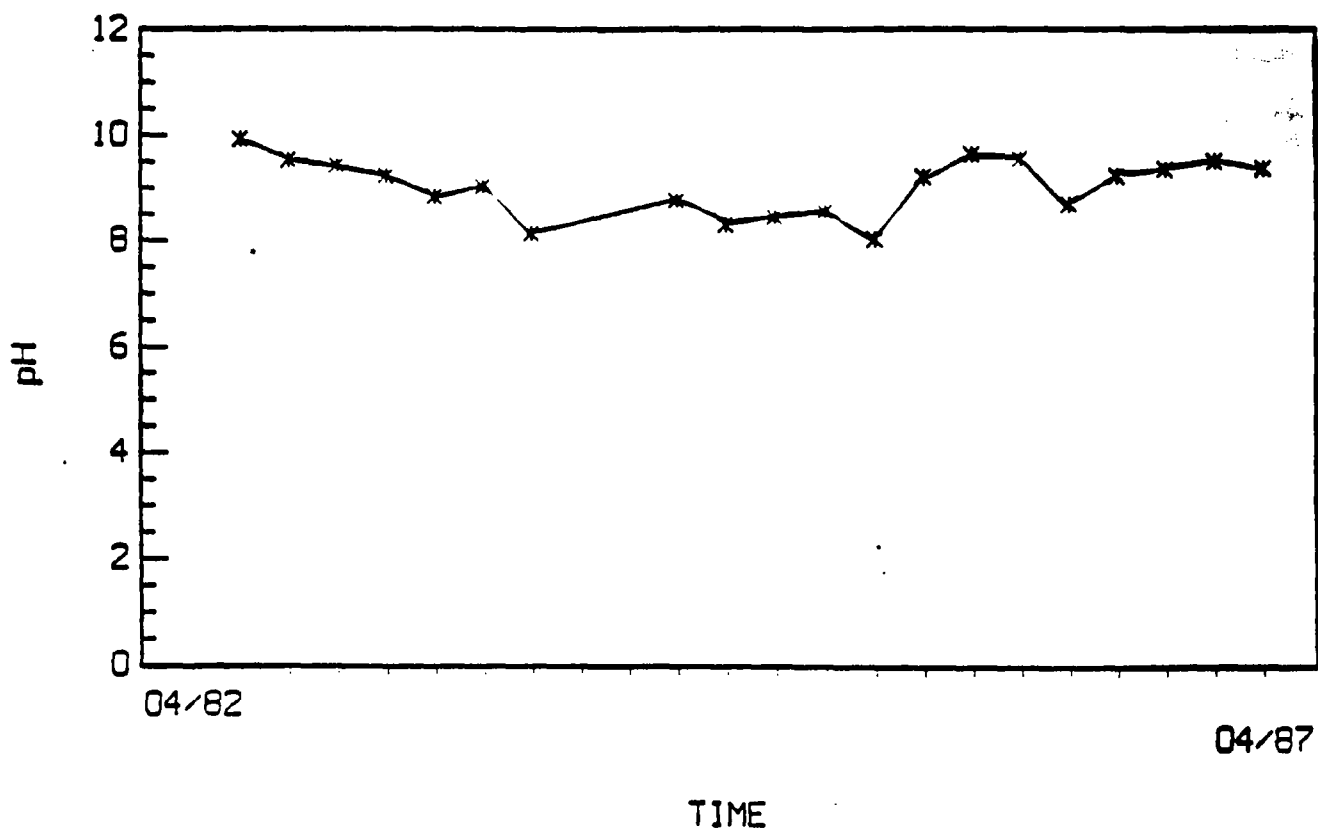
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-7

PH AT G-111A



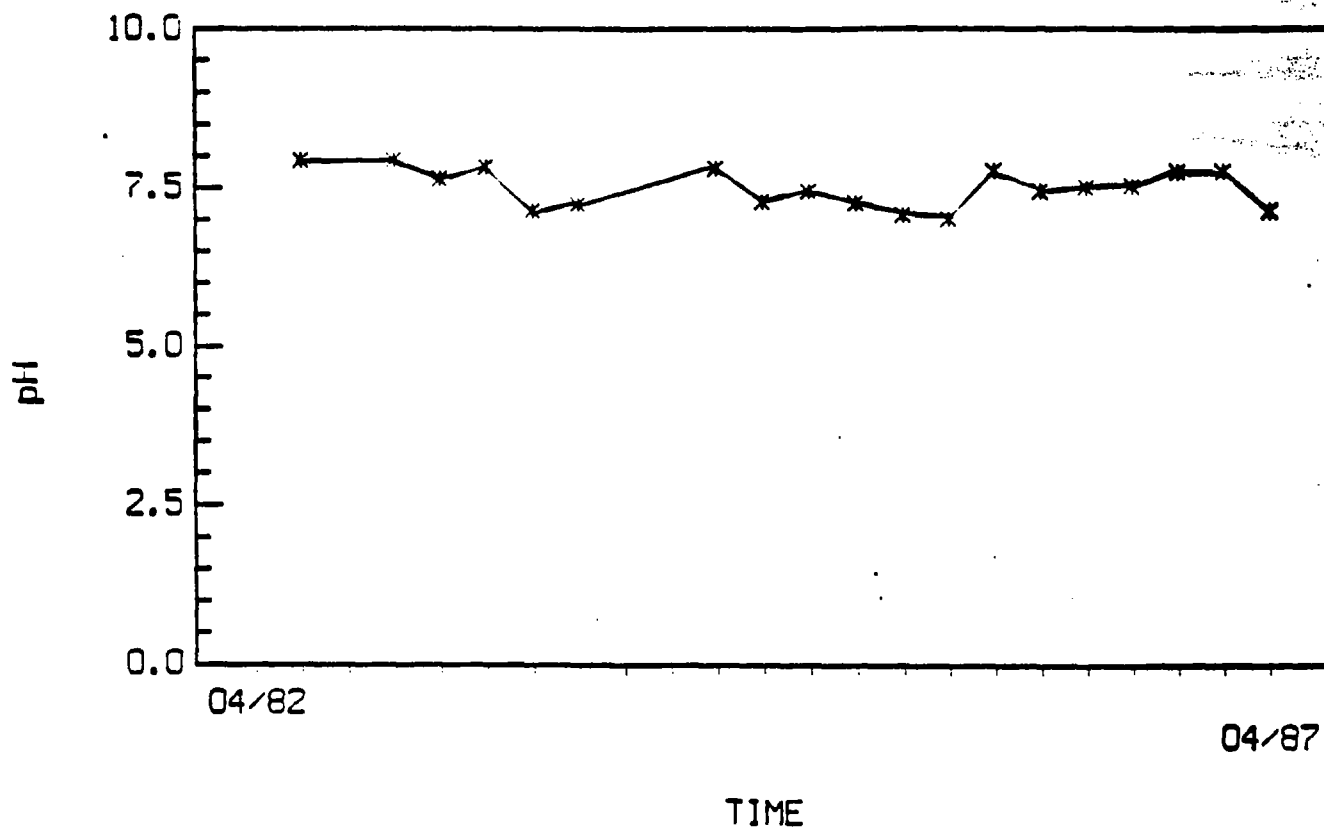
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-7

PH AT G-112B



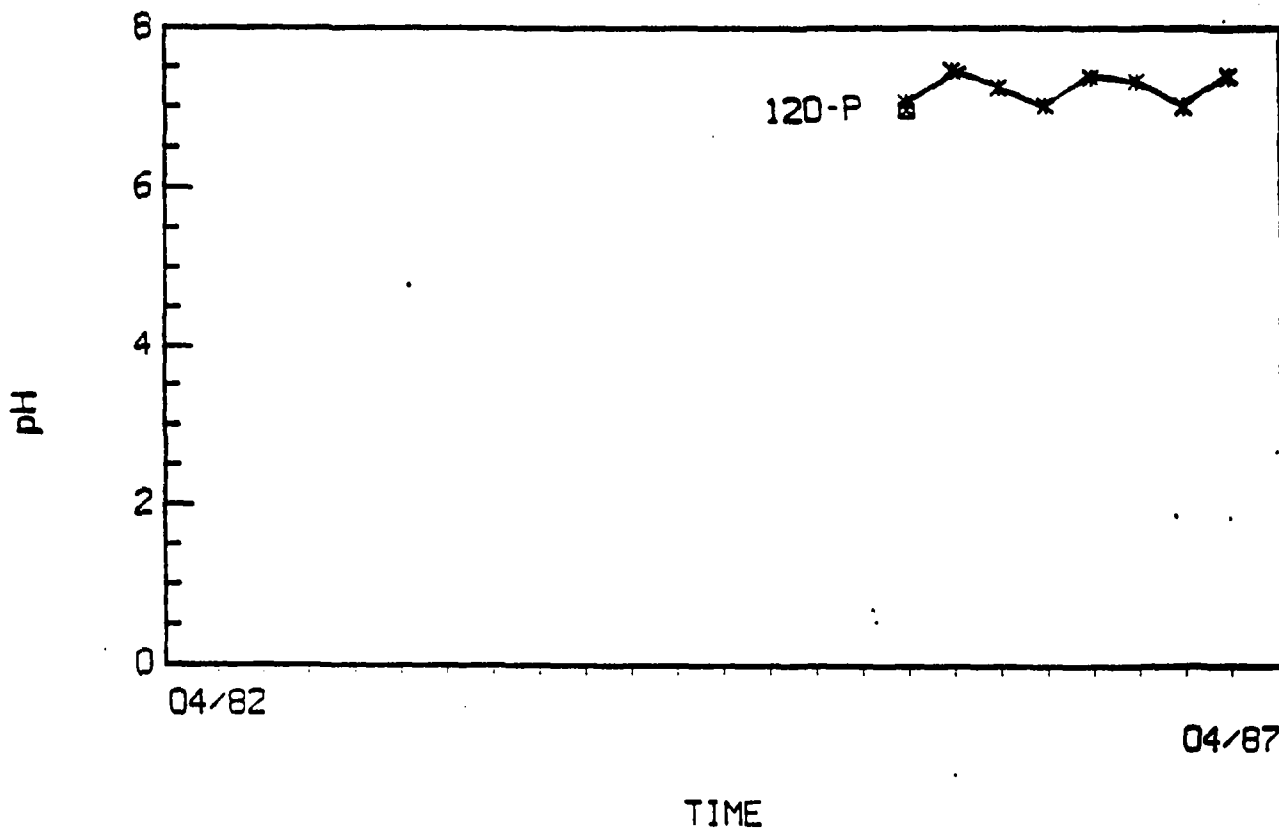
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-7:

# PH AT G-113A



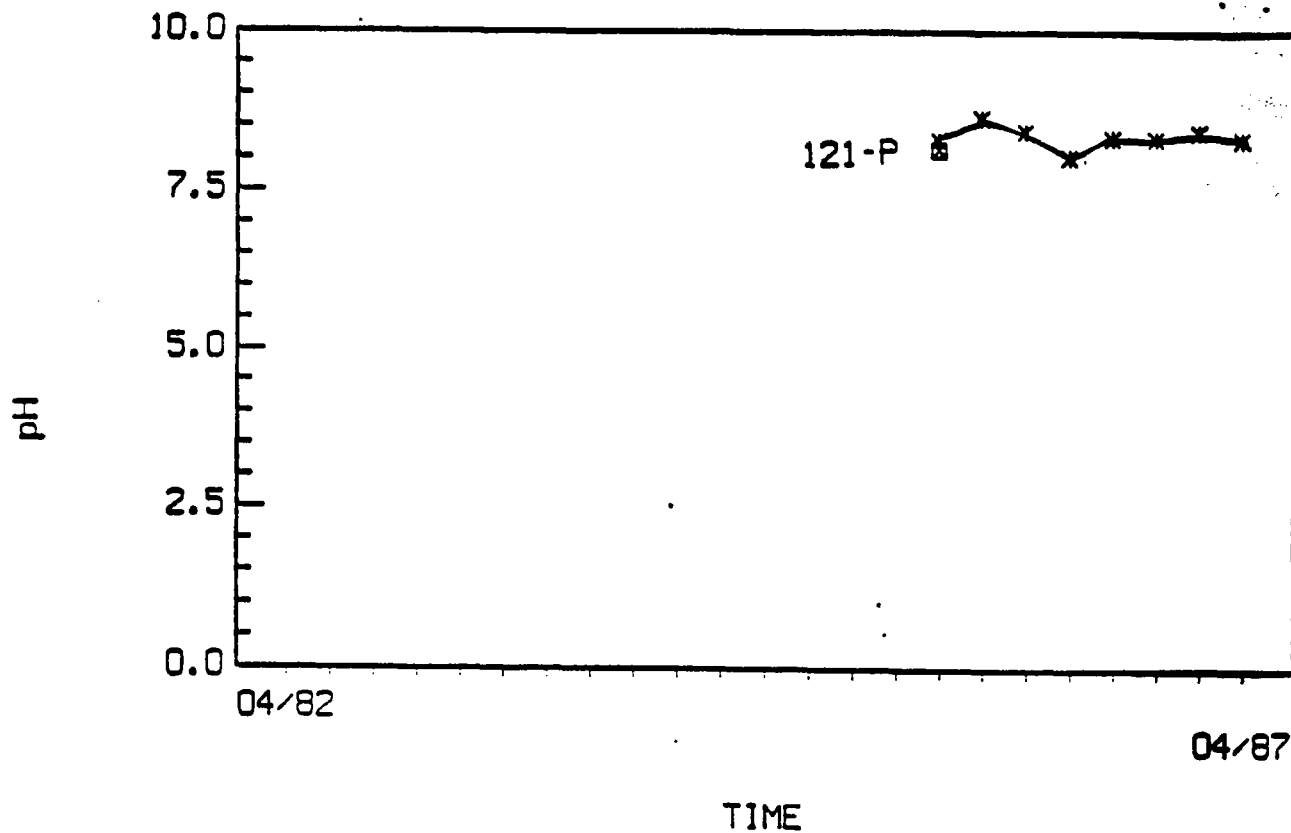
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-74

pH AT G-120S



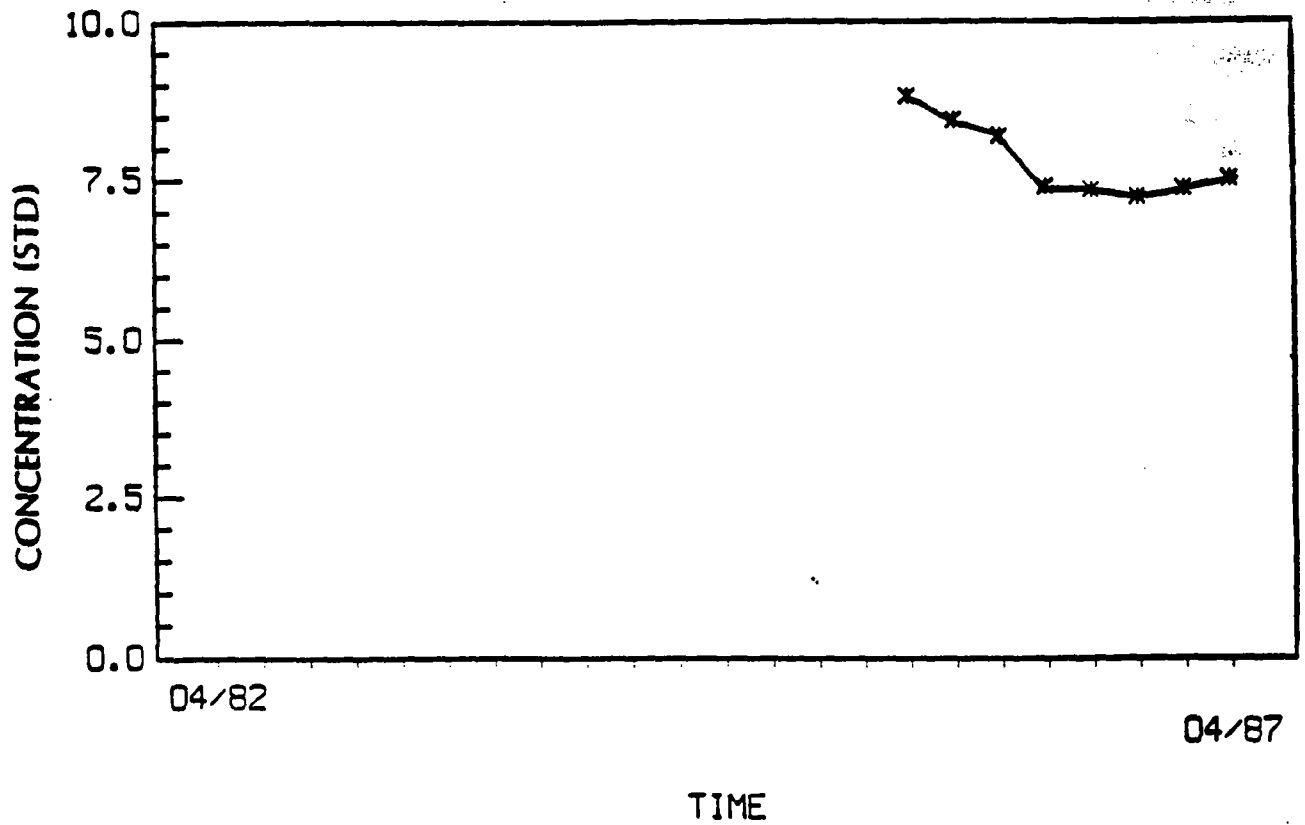
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-75

PH AT G-121S



JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		OWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-76

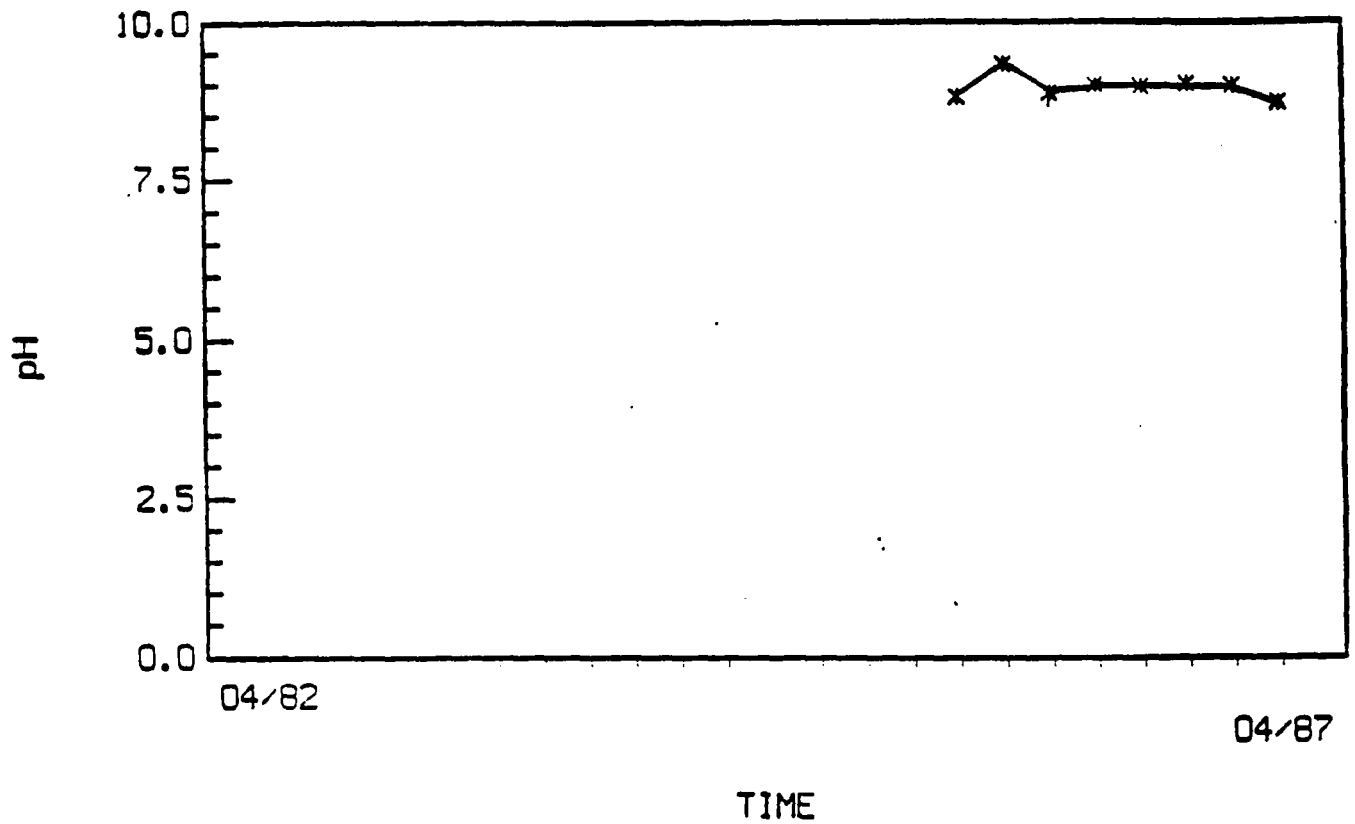
pH AT G-122S



JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG. NO.		
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC. FIGURE 9-7

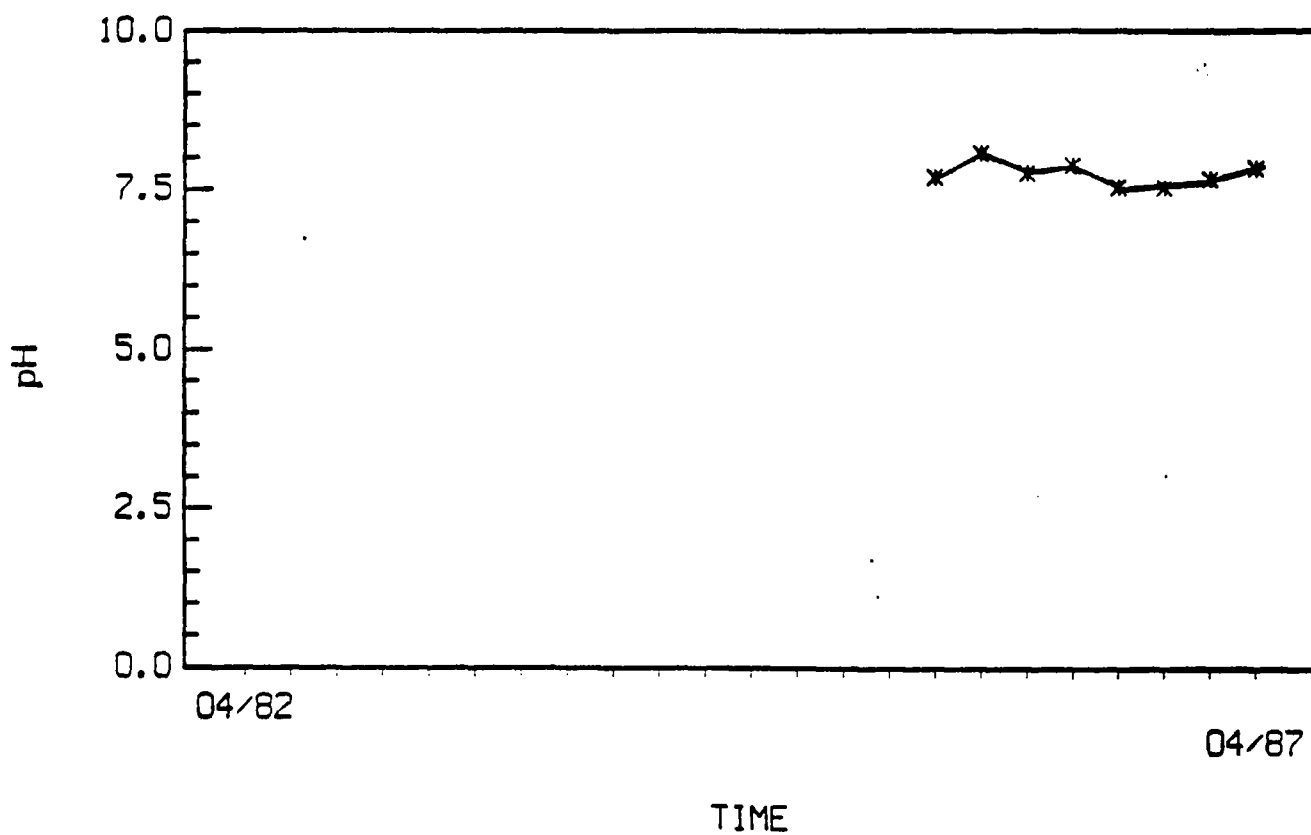


# pH AT G-123S



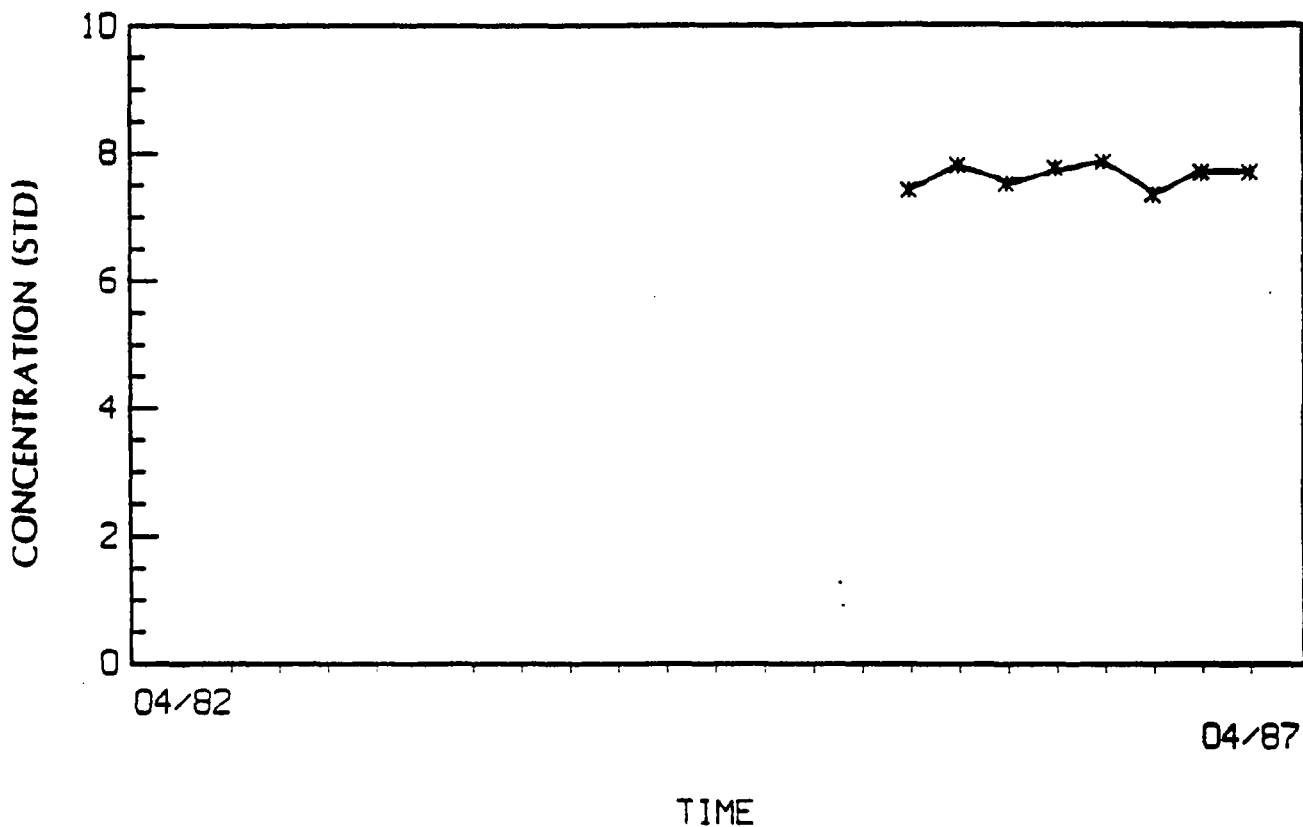
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-7

pH AT G-124S



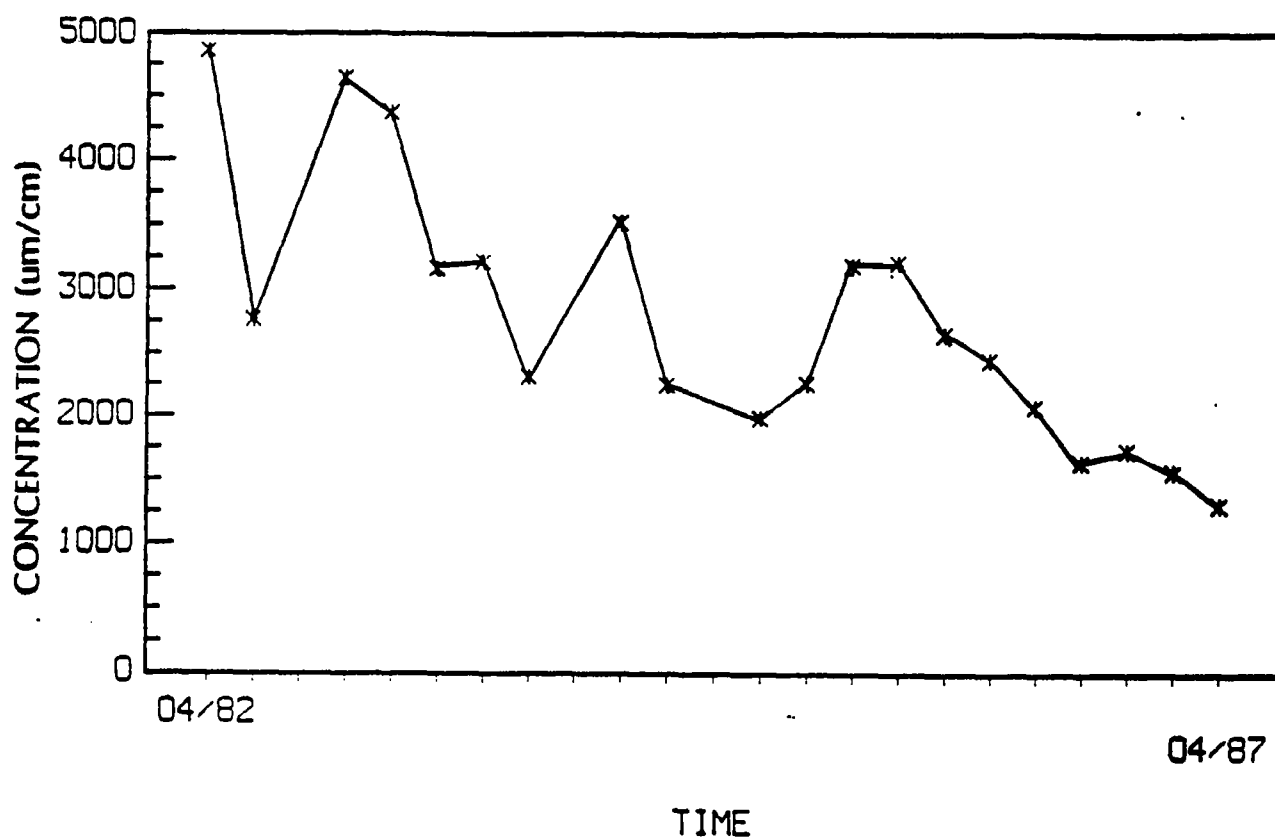
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-79

pH AT G-1255



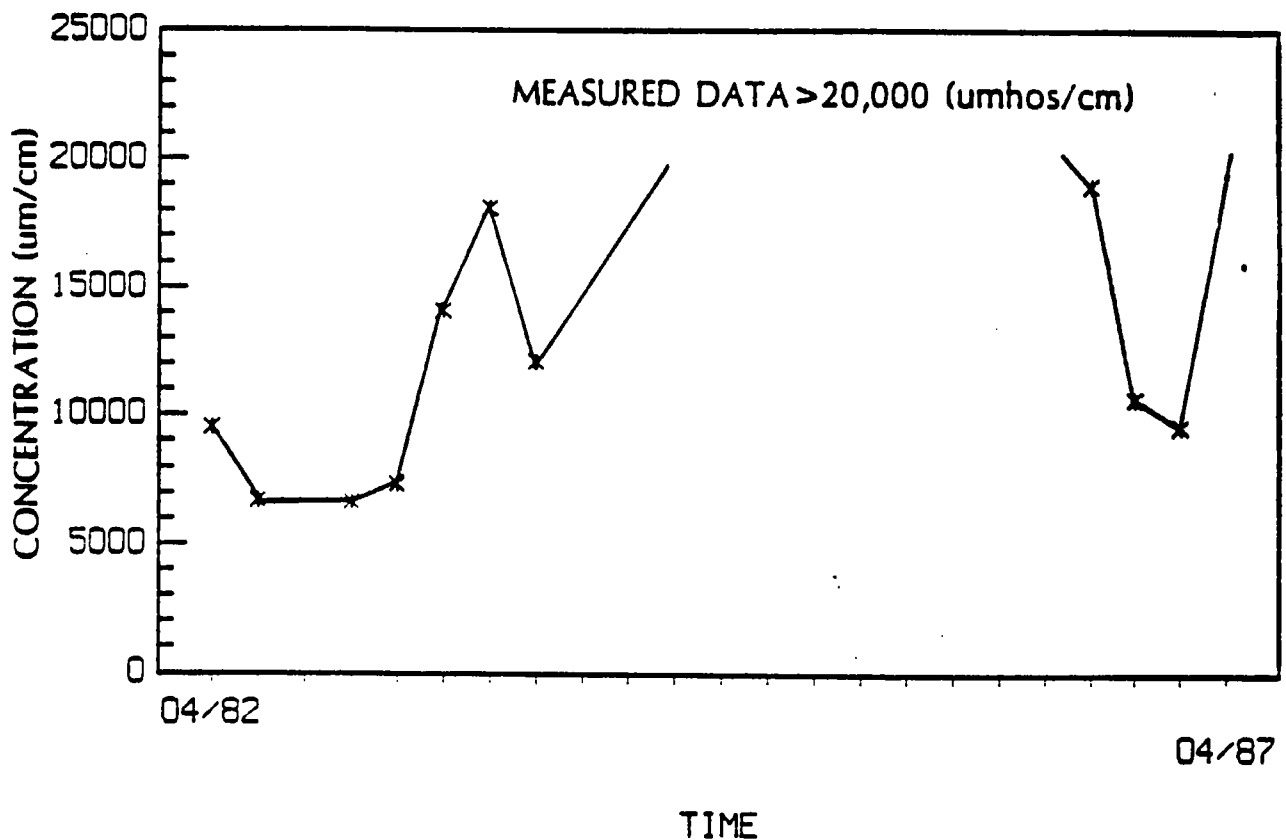
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-80

# SPECIFIC CONDUCTANCE AT G-110



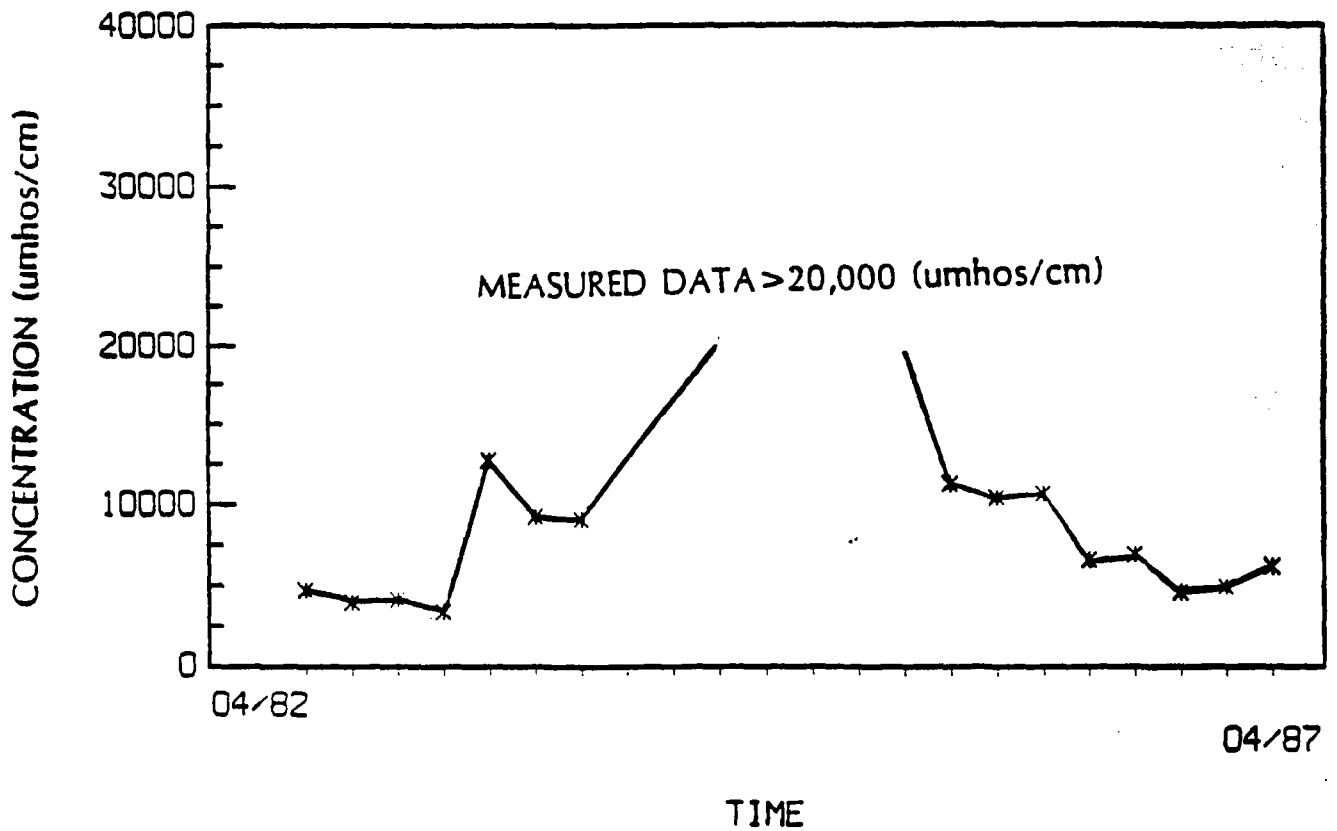
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-8

# SPECIFIC CONDUCTANCE AT G-111A



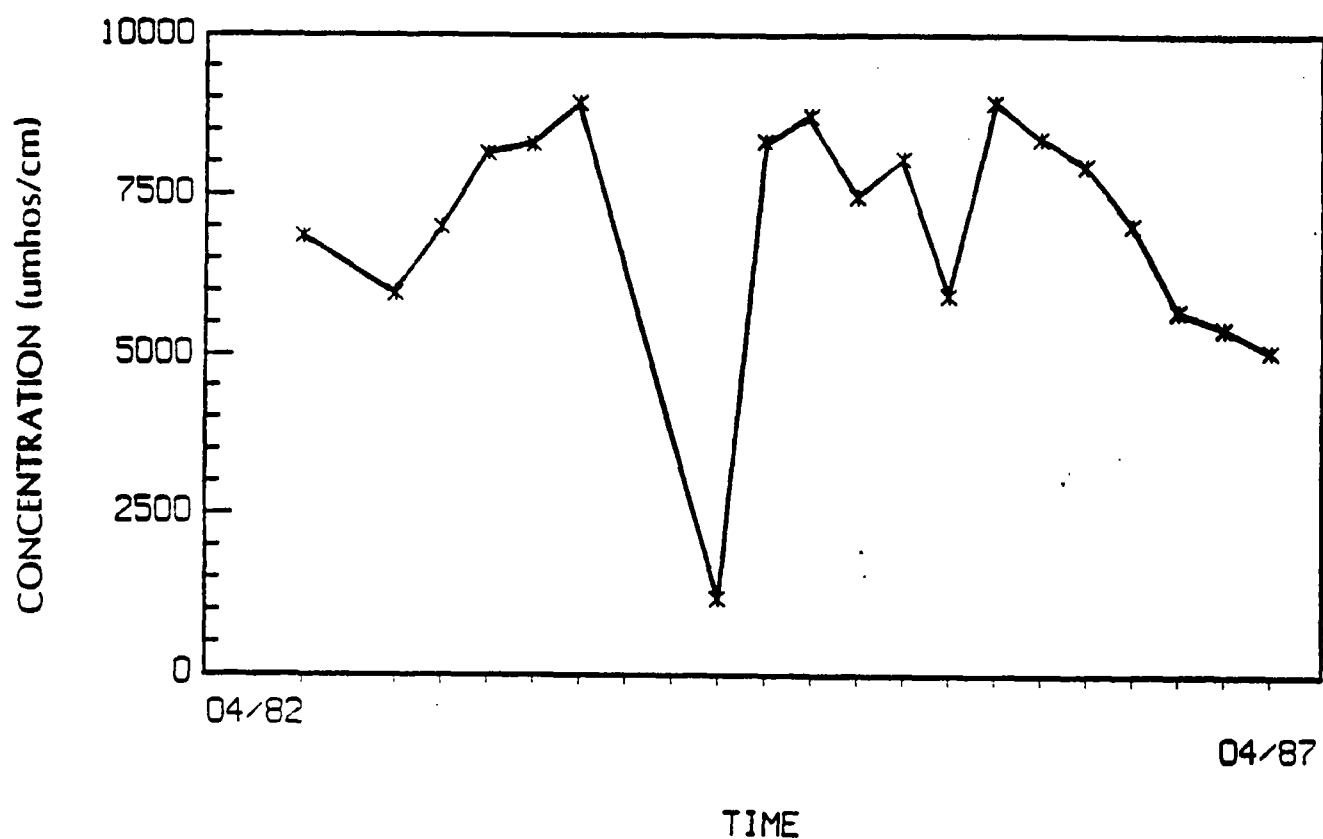
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-82

# SPECIFIC CONDUCTANCE AT G-112B



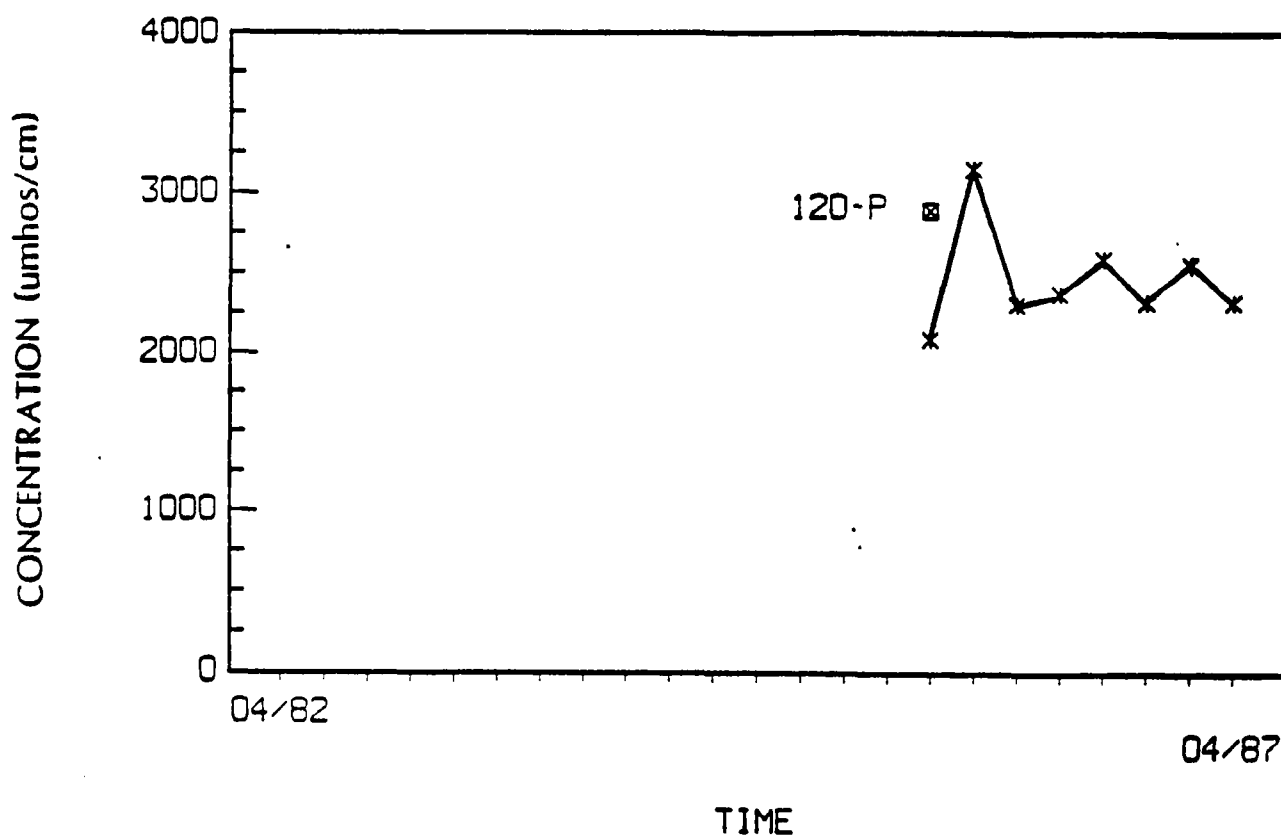
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-8

# SPECIFIC CONDUCTANCE AT G-113A



JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-8

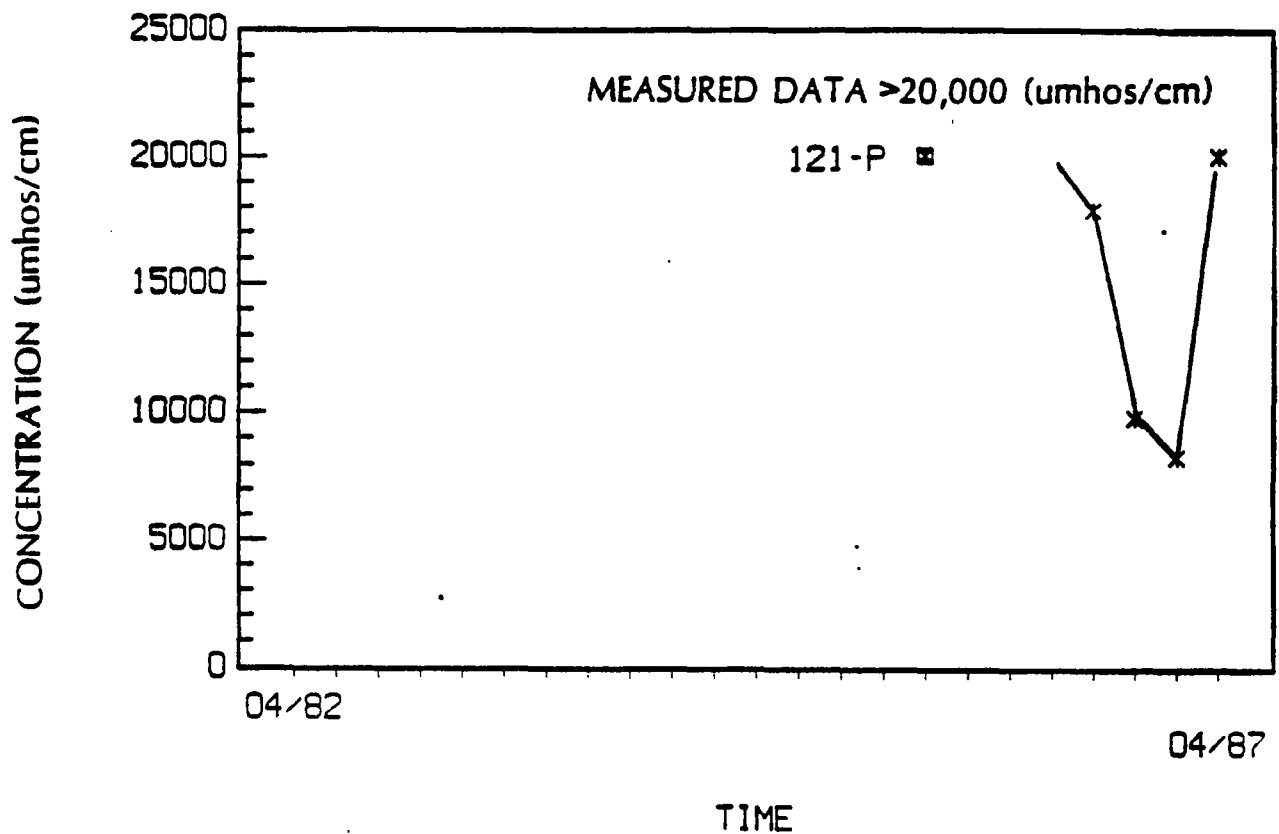
# SPECIFIC CONDUCTANCE AT G-120S



JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-8

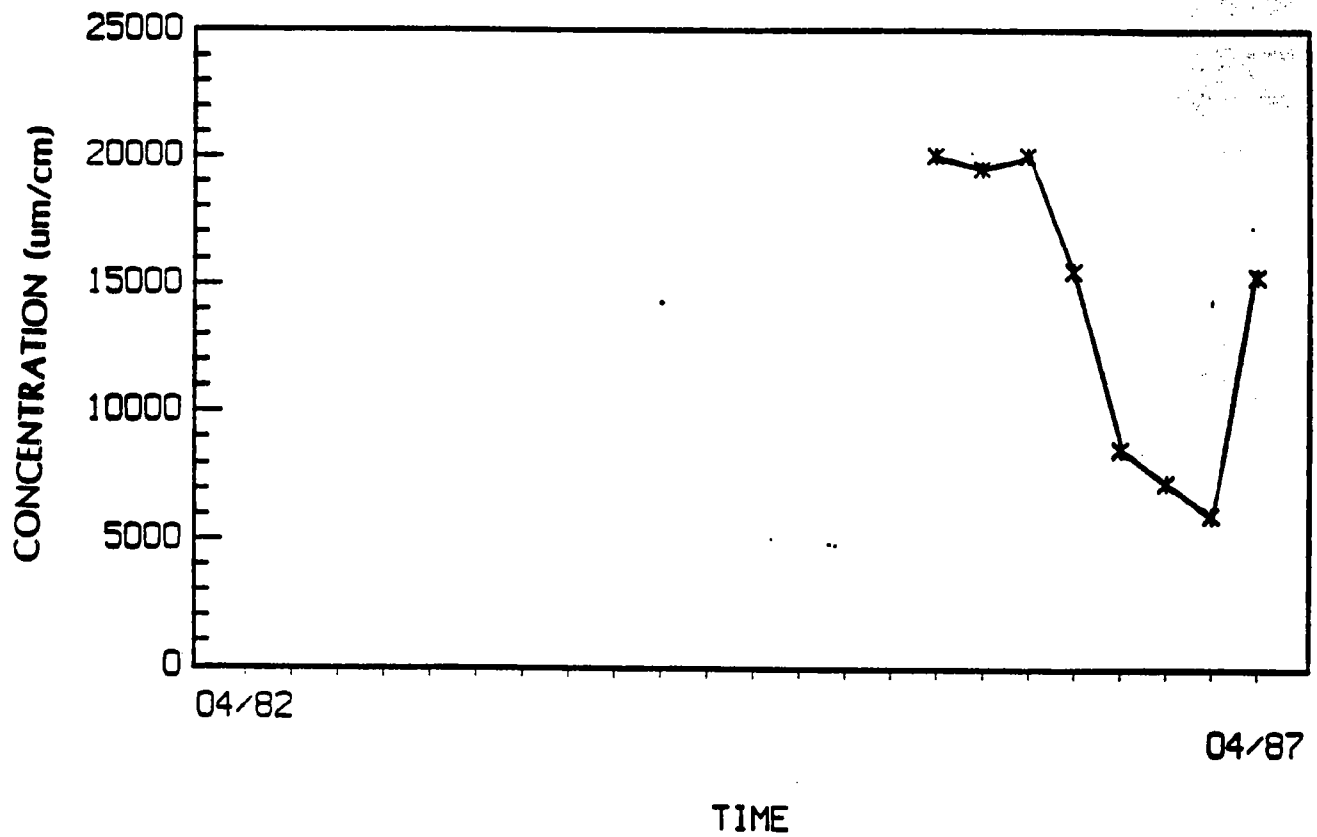


# SPECIFIC CONDUCTANCE AT G-121S



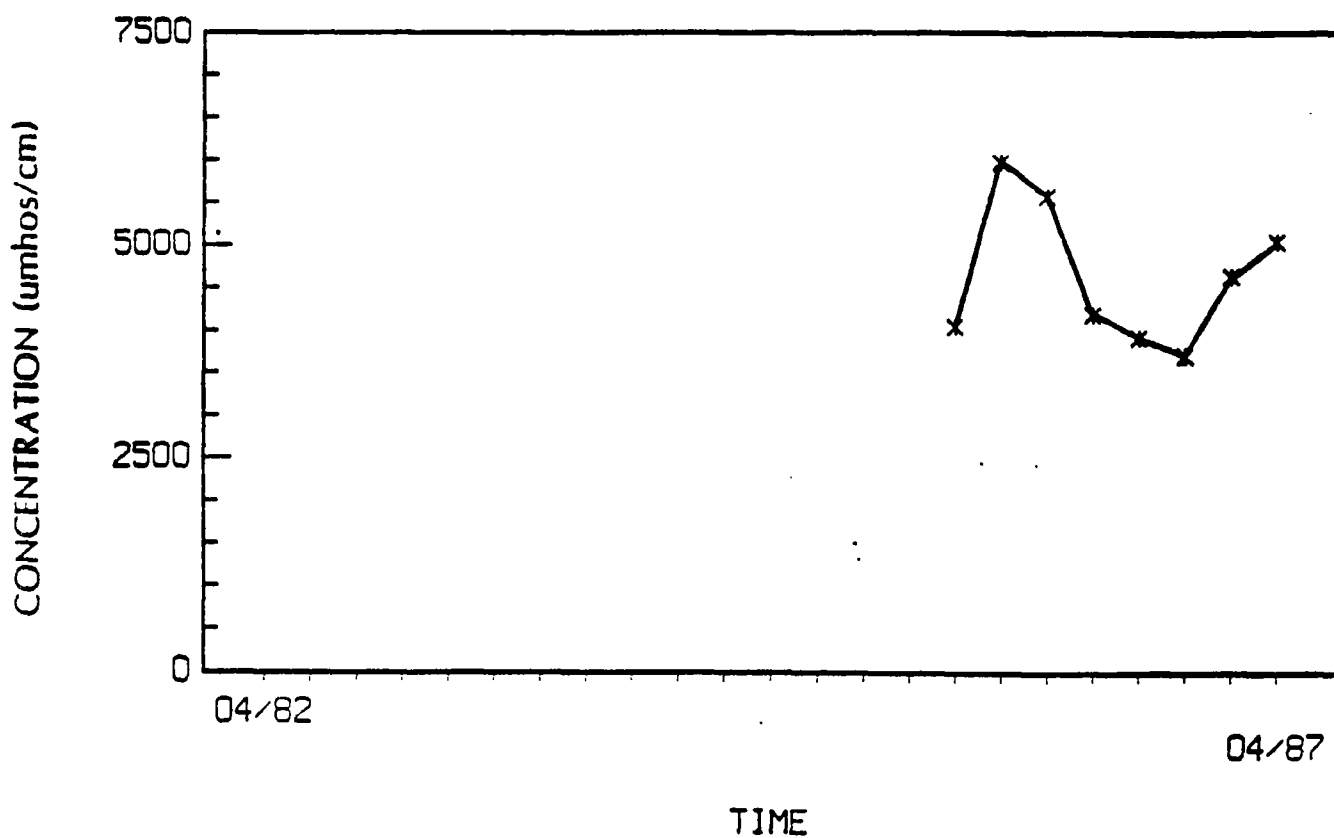
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-86

# SPECIFIC CONDUCTANCE AT G-122S



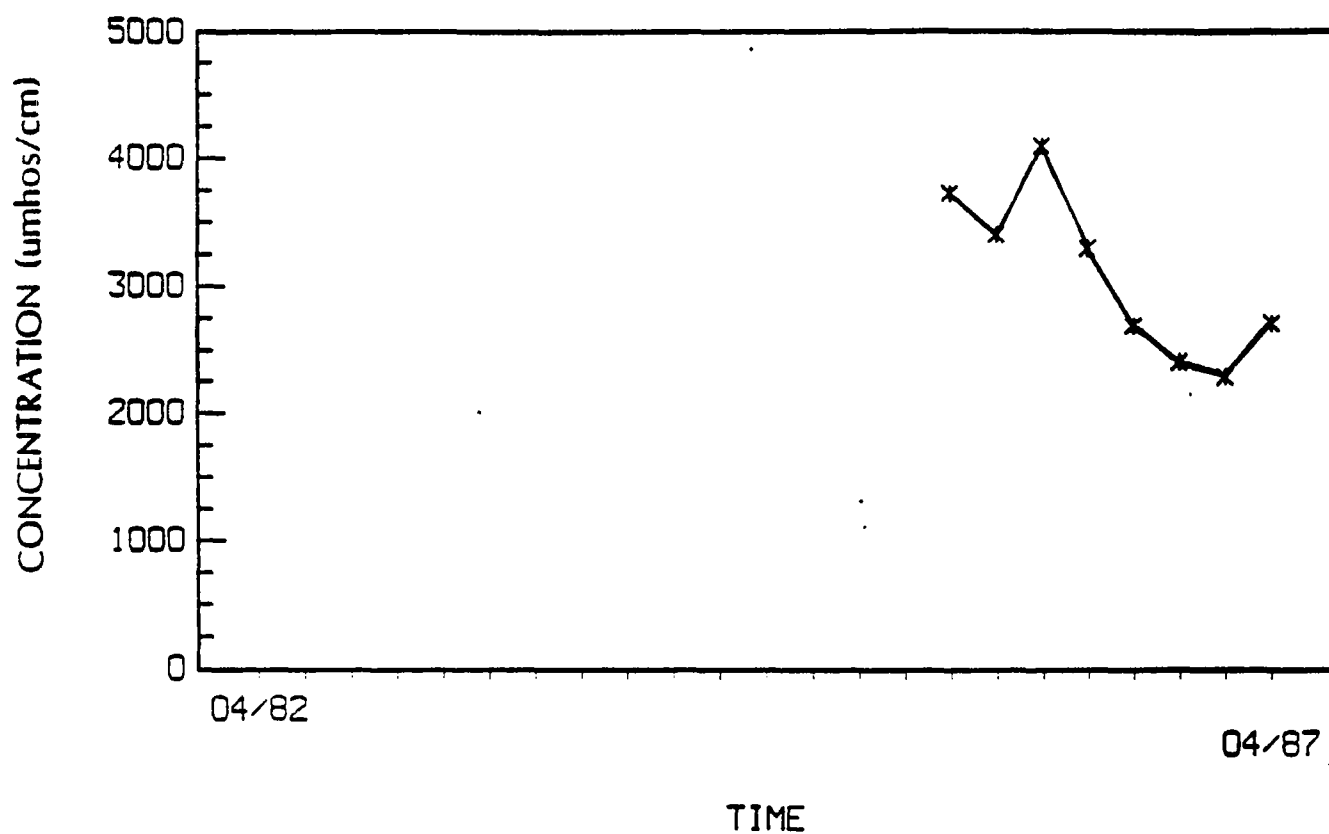
JOB NO.	873-2096	SCALE	N.T.S.	<p align="center"><b>TIME-TREND PLOTS</b>  <b>SCA CHICAGO INCINERATOR</b></p>
DRAWN	LWK	DATE	7/28/87	
CHECKED		DWG. NO.		
<p align="center"><b>Golder Associates</b></p>				<p align="center">CHEMICAL WASTE MANAGEMENT, INC.</p>

# SPECIFIC CONDUCTANCE AT G-123S



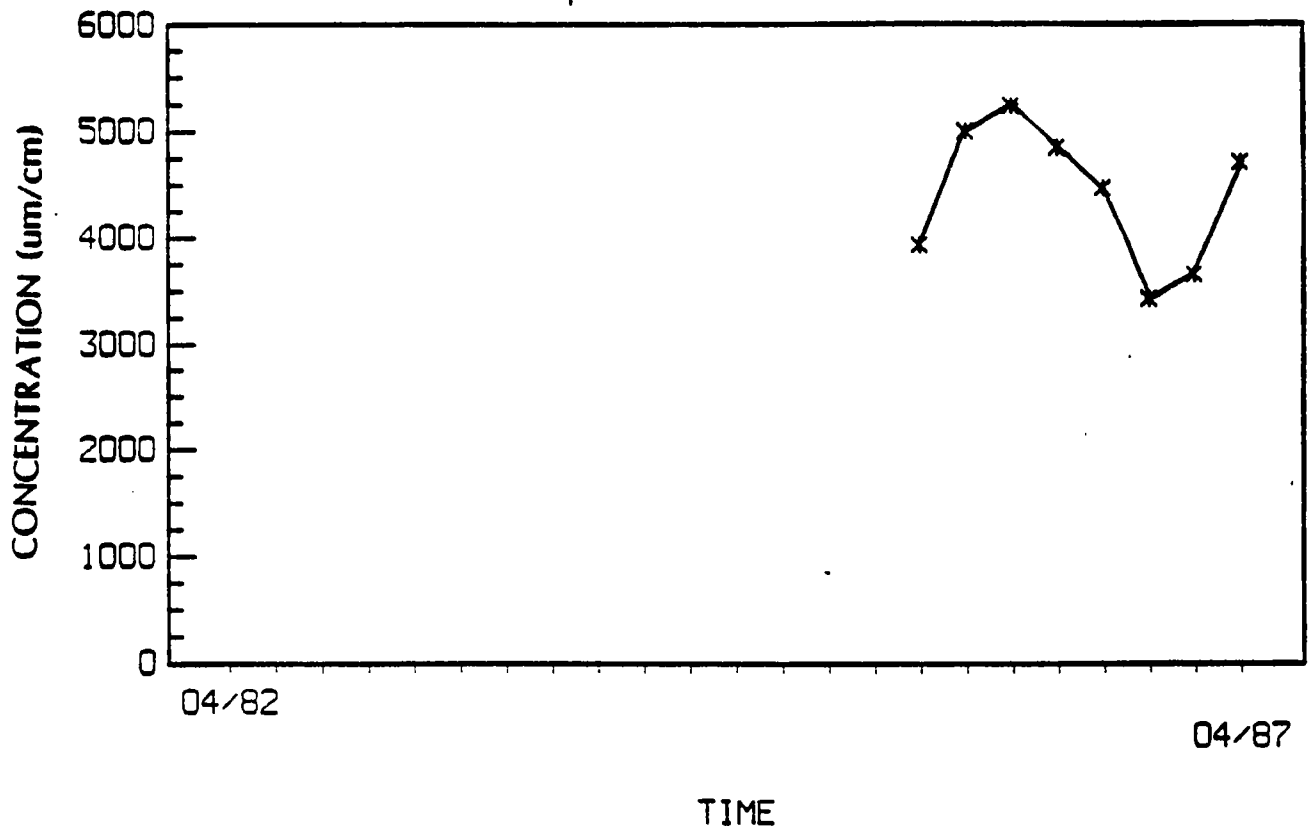
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-8

# SPECIFIC CONDUCTANCE AT G-124S



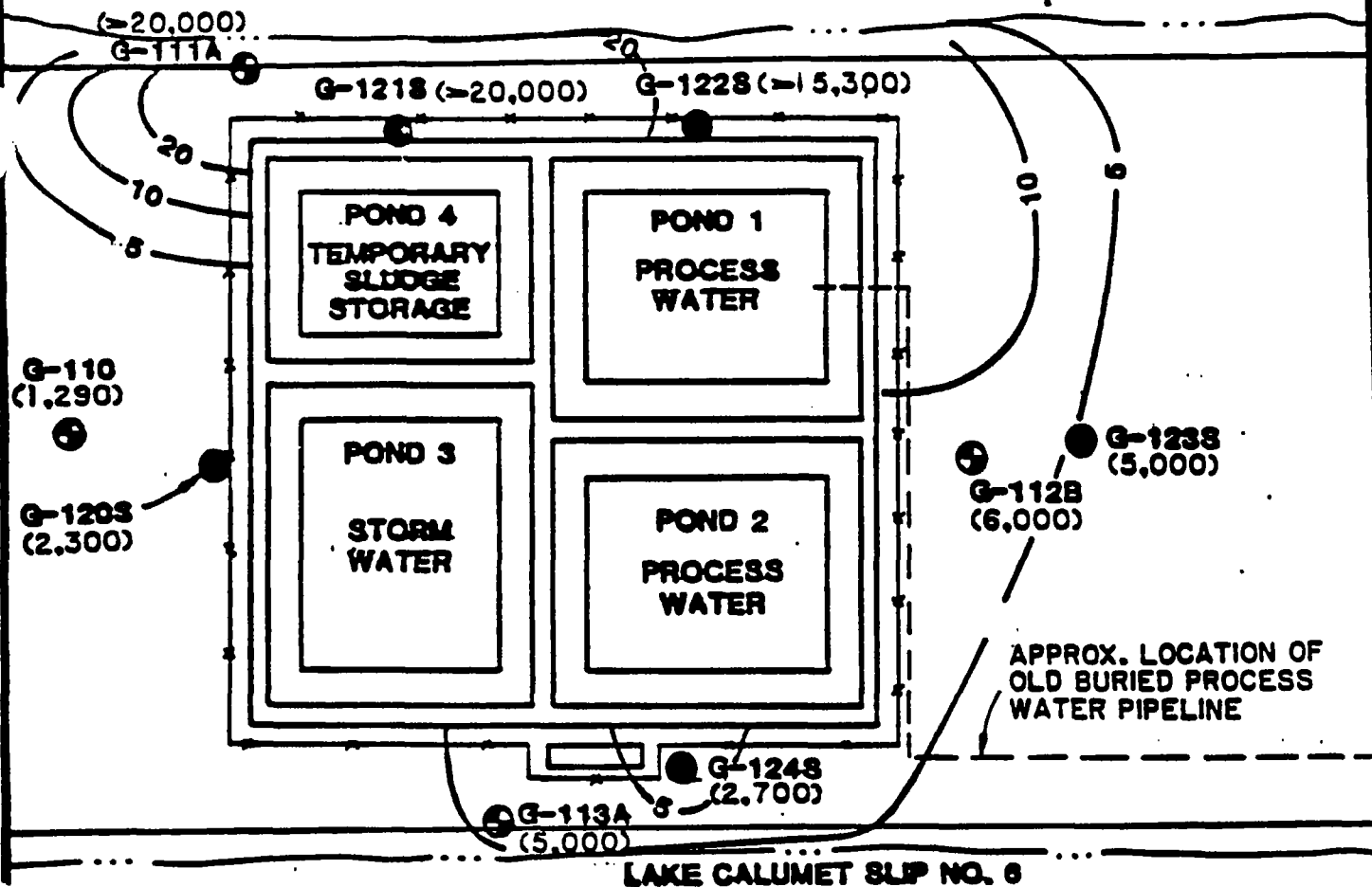
JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-8

SPECIFIC CONDUCTANCE AT G-125S



JOB NO.	873-2096	SCALE	N.T.S.	TIME-TREND PLOTS SCA CHICAGO INCINERATOR	
DRAWN	LWK	DATE	7/28/87		
CHECKED		DWG. NO.			
Golder Associates				CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 9-9C

# LAKE CALUMET SLIP NO.8



● G-110 MONITORING WELL NUMBER

(2,300) ELECTRICAL CONDUCTIVITY IN  $\mu\text{mhos/cm}$

—5— ELECTRICAL CONDUCTIVITY CONTOURS  $\mu\text{mhos/cm} \times 1000$

NOTES: (1) ELECTRICAL CONDUCTIVITY OF LAKE CALUMET WATER IS ON THE ORDER OF 900  $\mu\text{mhos/cm}$  (SCA, 1985).  
(2) VALUES MEASURES IN APRIL, 1987.

0 100' 200' 300'  
SCALE IN FEET

JOB NO. 873-209

SCALE 1"=100'

DRAWN BDL

DATE 7/31/87

CHECKED WMK

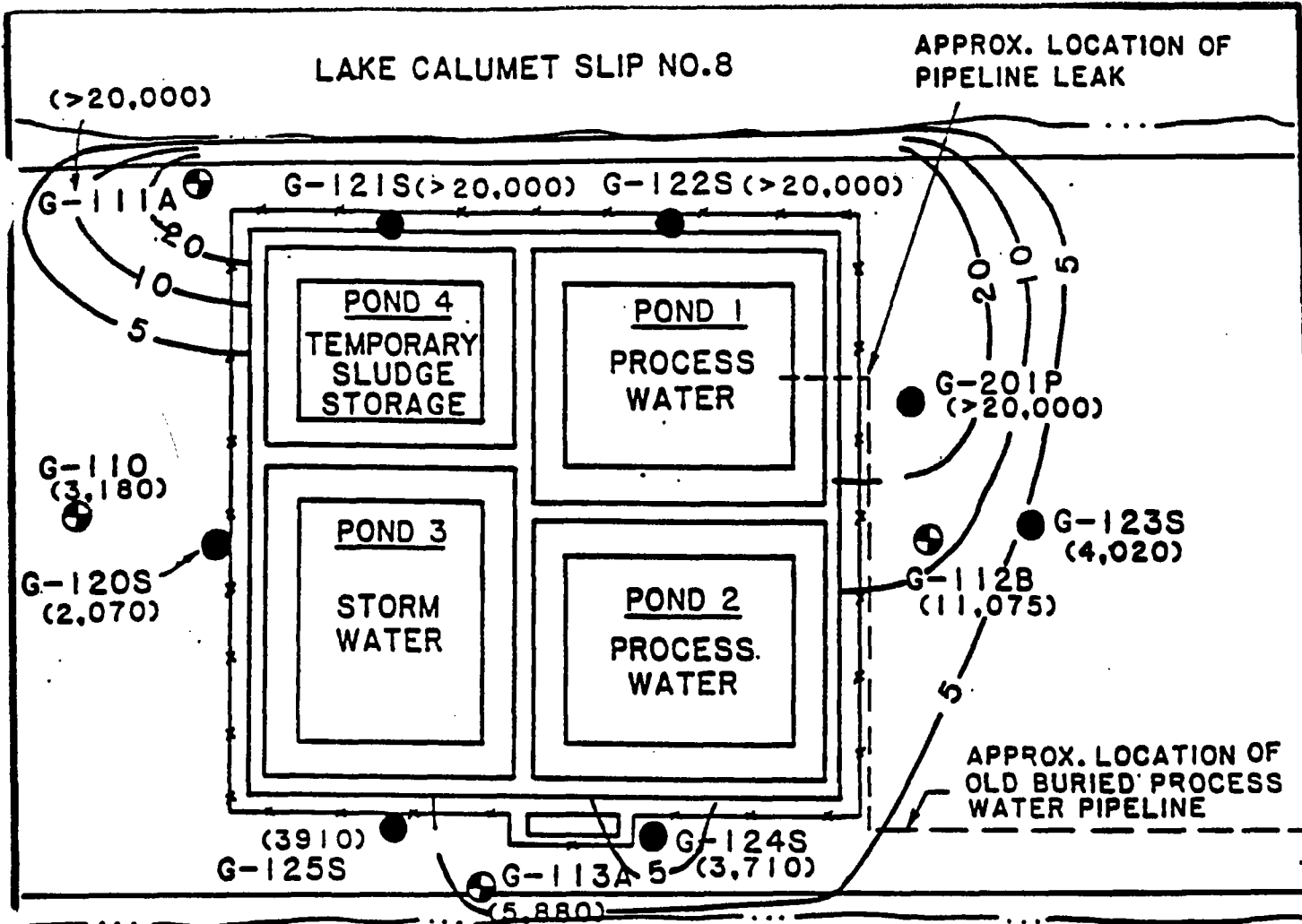
DATE

ELECTRICAL CONDUCTIVITY (1987)  
CONTOUR MAP  
OF SURFACE IMPOUNDMENT BASIN AREA

Golder Associates

SCA CHICAGO INCINERATOR

FIGURE 10



**LAKE CALUMET SLIP NO.6**

- G-110 MONITOR WELL NUMBER
- (3,180) ELECTRICAL CONDUCTIVITY IN  $\mu\text{mhos/cm}$
- 5 — ELECTRICAL CONDUCTIVITY  
CONTOURS IN  $\mu\text{mhos/cm} \times 1000$

NOTES: (1) ELECTRICAL CONDUCTIVITY OF LAKE CALUMET  
WATER IS ON THE ORDER OF 900  $\mu\text{mhos/cm}$  (SCA, 1985)

(2) VALUES MEASURES IN NOVEMBER, 1985, SEE TABLE 4-3

G. 232360

GRAPH

JOB NO.	873-2096	SCALE	1"=100'	<b>ELECTRICAL CONDUCTIVITY (1985) CONTOUR MAP OF SURFACE IMPOUNDMENT BASIN AREA</b>	
DRAWN	BDL	DATE	7/31/87		
CHECKED	WMK	DWG. NO.			
<b>Golder Associates</b>				SCA CHICAGO INCINERATOR	FIGURE 11



## **Golder Associates**

CONSULTING GEOTECHNICAL AND MINING ENGINEERS

VOLUME II  
GROUND-WATER ASSESSMENT REPORT  
SCA CHICAGO INCINERATOR FACILITY  
CHICAGO, ILLINOIS  
FOR  
SCA CHEMICAL SERVICES, INC.

(VOLUME II - APPENDICES A THROUGH F)

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2 copies - Golder Associates, Denver, Colorado  
1 copy - Golder Associates, Atlanta, Georgia

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673-2796



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- D WASTE MANAGEMENT INC. GROUND-WATER SAMPLING MANUAL
- E ANALYTICAL METHODS USED BY ETC
- F ANALYTICAL CHEMISTRY RESULTS

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- L METHODOLOGY TO DETERMINE RATE AND EXTENT

APPENDIX A  
GROUND-WATER ASSESSMENT PLAN

August 1987

873-2096

Golder Associates



Chemical Waste Management, Inc.

3003 Butterfield Road  
Oak Brook, Illinois 60521  
312/218-1500

BY FEDERAL EXPRESS

May 7, 1987

Mr. William Munro, Chief  
RCRA Enforcement Section  
United States Environmental  
Protection Agency  
Region V  
230 South Dearborn Street  
Chicago, Illinois 60604

RE: SCA Chemical Services, Inc.  
ILD 000 672 121

Dear Mr. Munro:

I am writing in response to a letter, dated April 30, 1987, from Basil Constantelos, which notified SCA Chemical Services, Inc. that its Chicago incineration facility was ineligible to receive waste from off-site response actions under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). In your letter you state that the United States Environmental Protection Agency (USEPA) has received information from the Illinois Environmental Protection Agency (IEPA) to the effect that the above-captioned facility is in "significant noncompliance with the groundwater monitoring requirements of 35 Ill. Adm. Code 725, Subpart F." It is our belief that the issues raised by IEPA in its March 25, 1987 letter have been resolved to that Agency's satisfaction, and that SCA is in compliance with applicable groundwater monitoring requirements.

Set forth below is a brief chronology of the events leading up to IEPA's March 25, 1987 letter, as well as SCA's response to this letter. Copies of pertinent correspondence are attached. By letter dated March 7, 1986, IEPA indicated that SCA had satisfactorily completed its initial groundwater quality assessment, and could return to indicator evaluation monitoring. By letter dated March 24, 1986, USEPA disagreed with IEPA's conclusion, and strongly recommended that IEPA require SCA to conduct quarterly determinations of the rate, extent and concentration of hazardous waste and hazardous waste constituents in the groundwater. IEPA responded by letter dated April 7, 1986, disagreeing with USEPA's conclusion, and

defending its original conclusion. This issue was finally resolved to the satisfaction of both agencies in July 1986.

In returning to indicator evaluation monitoring, SCA recognized that, due to existing groundwater conditions and deficiencies in the statistical procedures contained in the regulations, an assessment would be immediately triggered, even though no hazardous waste or hazardous waste constituents were migrating from its surface impoundments. It therefore attempted to obtain the approval of both USEPA and IEPA for the use of alternative statistical methodologies which it believes are better able to determine whether hazardous wastes are actually migrating from its surface impoundments. To that end, SCA met with IEPA and USEPA on a number of occasions between July 1986 and October 1986 to discuss these methodologies.

On October 20, 1986, SCA met with IEPA and USEPA to discuss its alternative statistical methodologies and IEPA's contention that a statistically significant increase noted during the August 1986, sampling event had triggered a groundwater quality assessment. At that meeting, you indicated that you believed that USEPA could accept a technically justified "alternative assessment" program as a continuation of the previous groundwater assessment, if IEPA concurred. IEPA took the position that SCA had returned to indicator evaluation monitoring and that the statistically significant increase noted in the August sampling event had triggered a groundwater quality assessment.

In response to this meeting, SCA immediately developed a groundwater assessment plan, which it submitted to both agencies on the next day, October 21, 1986. In light of the previous conflicting signals which SCA had received from USEPA and IEPA, it requested their concurrence. In addition, IEPA's past practice was to approve SCA's assessment plans. IEPA responded to the October 21, 1986 submittal with a compliance inquiry letter dated December 18, 1986 (received by SCA on December 23, 1986). SCA responded to the issues raised in IEPA's compliance inquiry letter, most of which were also addressed in a letter from you dated January 14, 1987, by letter dated January 21, 1987. In our letter, we requested an opportunity to meet with IEPA to discuss these issues. The request for a meeting was repeated orally on a number of occasions in February and March 1987.

In a compliance inquiry letter dated March 25, 1987, IEPA noted that SCA's annual report had not been submitted, and raised some of the issues which it previously had raised in its December 18, 1986 letter. SCA responded by letter dated April 8, 1987, in which it noted that its annual report had been submitted (on April 4, 1987), and again requested an opportunity to discuss these issues with IEPA. (Before the March 1, 1987 deadline, SCA had notified IEPA that its report would be delayed, due to data processing problems.) A meeting was

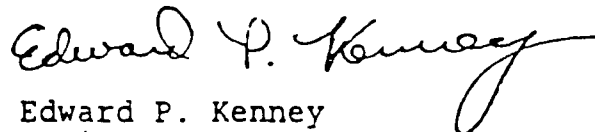
conducted with IEPA on April 23, 1987 in Springfield, and Rick Herseemann of your staff participated by telephone. It was SCA's understanding that the outstanding issues concerning the groundwater quality assessment had been resolved to IEPA's and USEPA's satisfaction as a result of that meeting. Groundwater sampling was conducted during the week of April 27, 1987 for the assessment, and SCA will complete the assessment report as soon as possible. SCA submitted a letter to IEPA, dated April 30, 1987, which sets forth the agreements reached in this meeting.

SCA has made great efforts to keep both USEPA and IEPA informed concerning its groundwater monitoring efforts, and to eliminate the potential for misunderstandings. Throughout the course of the above described events, SCA has acted in good faith, and has done its best to deal with at times conflicting demands by USEPA and IEPA. Since SCA is in compliance with applicable groundwater monitoring requirements, USEPA's notice of ineligibility should be withdrawn.

We are willing to meet with you to discuss this matter, if a meeting would be productive. If you have any questions or comments, please do not hesitate to contact Jodie Bernstein or the undersigned at (312)218-1648. It is important that this issue be resolved as soon as possible, because USEPA's action has had an immediate adverse business impact on SCA.

Thank you for your assistance in this matter.

Very truly yours,



Edward P. Kenney  
Environmental Counsel  
for SCA Chemical Services, Inc.

EPK:kg  
Attachment

cc: Walter Barber (w/att.)  
Robert Bartholomew (w/att.)  
Don Brady (w/att.)  
Jodie Bernstein (w/att.)  
William Child (w/att.)  
Harry Chappel, (w/att.)  
Basil Constantelos (w/att.)  
Lynn Kleinvehn (w/out att.)  
David Ullrich, (w/att.)  
Roger Zehntner (w/out att.)



Illinois Environmental Protection Agency 2200 Churchill Road, Springfield, IL 62706

REC-5-26-87  
R.

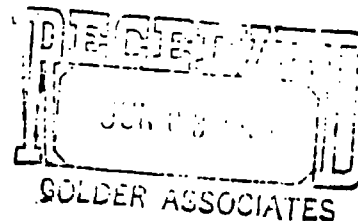
853-2054

217/782-6761

cc: C. Brady  
- K. ...  
E. ...

Refer to: 0316000058 -- Cook County  
Chicago/SCA Chemical Services  
ILD000672121  
Subpart F Groundwater Monitoring

May 21, 1987



SCA Chemical Services  
Attn: Robert Bartholomew  
11700 South Stony Island Avenue  
Chicago, IL 60617

Dear Mr. Bartholomew:

The Agency has received and reviewed your April 29, 1987 submittal. The following questions or comments follow SCA's numbering system:

1. How does SCA plan to sample the four (4) stainless steel wells (120S, 121S, 123S, and 124S)? Specific monitoring well sampling techniques should be outlined in the assessment report.
2. As discussed with both Lynn Kleinvehn and yourself, dioxin and furans should be analyzed for during assessment monitoring. Analytical methods must follow those outlined in SW846 for Appendix IX sampling, specifically, method 8280 for dioxins/furans analysis. Sampling and analysis methods should be specified in the assessment report.

Please note groundwater samples subjected to total metals analysis should not be filtered. Preservatives should be added to the specific sample before transportation to the laboratory.

Samples selected for dissolved metal analysis should be filtered in the field, utilizing required preservative techniques. If samples are filtered in the laboratory, no preservatives should be added to the samples in the field. Preservatives should be added after filtering is conducted in the laboratory. If groundwater samples are not filtered in the field, the facility must filter the specific sample in the laboratory within one (1) hour after sampling has occurred.

3. How will raw data be evaluated? Specific evaluation techniques must be included with the assessment report.
4. Based on past information submitted by the facility (i.e., RCRA Certification dated November 7, 1985), it would appear that all four (4) impoundments are RCRA regulated, not just Cooling Basin 1 and 2. Why does SCA deem it appropriate to only include Cooling Basin 1 and 2 in their assessment investigation? This discussion should be provided in the assessment report.
5. The assessment report should document how the determination that hazardous waste or hazardous waste constituents have or have not migrated from the surface impoundments to groundwater. The assessment report must address what steps will be taken to determine the rate and extent of contamination migration if a release is confirmed. This should include a schedule of implementation.

It is unclear to this Agency what SCA means by "SCA may continue to monitor the background water quality in the above referenced wells to supplement our conclusion that hazardous waste constituents have not migrated from the impoundment". Until the assessment report is completed, it would not seem appropriate to reach any "conclusion" regarding continued monitoring at the facility. The assessment report should further explain these statements.

The Agency continues to feel that 120 days is an adequate time period to complete an initial assessment investigation. The Agency would like to propose the following assessment schedule:

SCHEDULE

<u>Item</u>	<u>Duration</u>	<u>Cumulative</u>
Mobilization	10 days	10 days (April 24, 1987)
Sampling and Analysis (resampling if required)	60 days	70 days (June 23, 1987)
Evaluate Data (rate and extent determination)	30 days	100 days (July 23, 1987)
Prepare and Submit Report	20 days	120 days (Aug. 12, 1987)

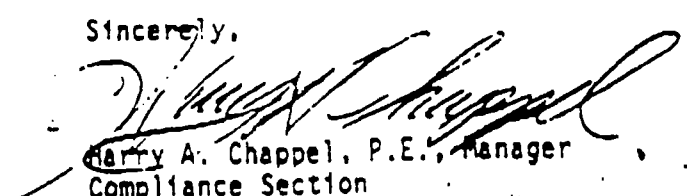
The Agency is aware of unforeseen circumstances that may arise which may delay or provide grounds for altering an assessment schedule, however, please note that any delays/changes in the above mentioned schedule by SCA will be reviewed by this Agency as to individual merit. Specific delays/changes in said schedule must be documented and verified by the facility before a change in the schedule may occur.

The aforementioned assessment schedule will also serve as a compliance schedule to which you must adhere. The assessment report must address specifics outlined in the assessment plan. The final report must be submitted to this Agency no later than August 12, 1987.

Please be advised that any future assessment plan submitted under 111. Adm. Code Section 725.193(d)(2) should contain the information requested in 1, 3 and 5 above, as well as all other information required by the regulations.

If you have any questions pertaining to the above, please feel free to contact me or Stephen Davis of my staff at the above number.

Sincerely,



Harry A. Chappel, P.E., Manager  
Compliance Section  
Division of Land Pollution Control

HAC:SKD:tk:2/14/40

cc: Division File  
Bill Child  
Northern Region  
USEPA, Region V  
Rick Hersemann  
Stephen Davis  
Paul Jagiello  
Michelle Tebrugge  
Compliance Correspondence Log (A)



**Chemical Waste Management, Inc.**

3003 Butterfield Road  
Oak Brook, Illinois 60521  
312/654-6800

DRAFT

Illinois Environmental Protection Agency  
Division of Land Pollution Control  
2200 Churchill Road  
P.O. Box 19276  
Springfield, IL 62794-9276

Attention: Mr. Harry A. Chappel, P.E.  
Manager-Compliance Section

RE: SCA Chicago Incinerator - Surface Impoundments  
Groundwater Assessment Plan

Dear Mr. Chappel:

This letter will revise the subject Groundwater Assessment Plan originally submitted on October 21, 1986. The revised plan is a result of our meeting on April 23, 1987. This meeting was held to resolve agency comments on our proposed plan highlighted in a Compliance Inquiry Letter dated December 18, 1986. To prevent any misunderstanding, the attached revised assessment plan will supercede October's submission.

If you have any further comments on this plan, please contact me at your earliest convenience. We are planning to have the sampling take place during the last week of April.

Respectfully submitted,

Robert Bartholomew  
Manager, Health, Safety & Environmental  
Compliance

cc: Don Brady-CINC  
William Muno-USEPA  
Lynn Kleinvehn-NR EMD

Revised Groundwater Assessment Plan  
SCA Chicago Incinerator

The groundwater assessment will be performed according to the following steps:

1. The four stainless steel wells (120S, 121S, 123S and 125S) adjacent to the four RCRA monitoring wells will be sampled. The circulating pump discharge from the impoundments will also be sampled.
2. Samples will be analyzed for proposed Appendix IX constituents with the exception of dioxin and furan compounds. Metal analyses will also be run on filtered samples to provide consistency with site metals data base.
3. Raw data will be evaluated, together with previously gathered data to determine if retesting is required.
4. The well and impoundment data will be evaluated to determine if hazardous waste constituents found in the groundwater, if any, could have come from the regulated units (Cooling Basin 1 & 2).
5. If determination indicates no relationship, the assessment will conclude. All supporting documentation for the no release conclusion will be included in the assessment report. - If there is evidence of a release from the regulated unit, the rate and extent of the contamination migration will be determined.

The assessment will be conducted per the following schedule:

Schedule

<u>Item</u>	<u>Duration</u>	<u>Cumulative</u>
Mobilization	10	10
Sampling & Analysis	60	70
Evaluate Data	40	110
Prepare & Submit Report	30	140

In an effort to approach the 120 day time frame suggested by the IEPA, this schedule does not allow for any delays common to these types of studies i.e., resampling. If such an event impacts the schedule, the IEPA will be promptly notified and provided with a revised schedule.

This assessment plan has been reviewed by a qualified geologist or geotechnical engineer as evidence by the attached certification statement.

*Bob Bartholomew*

SCA CHEMICAL SERVICES

11700 S. Stony Island Avenue  
Chicago, Illinois 60617  
(312) 646 5700



October 21, 1986

Mr. Richard Carlson  
Illinois Environmental Protection Agency  
2200 Churchill Road  
Springfield, Illinois 62706

Dear Mr. Carlson:

Pursuant to a meeting of October 20, 1986 with IEPA and USEPA personnel, SCA is submitting this notice and Assessment Plan No. 2, per Title 35 IAC 725.193(d) that the facility may be affecting ground water quality as indicated by failure of the t-test. It is our position that this notification and subsequent assessment are neither required, nor necessary.

Per the conclusion of the recent assessment, the quality of the ground water will continually result in a statistical failure of the t-test. Therefore, resampling to ascertain a laboratory artifact or error was not deemed technically appropriate and the t-test failure was conceded. As determined by the recent hydrogeological study, the extremely slow rate of ground water movement prevents the ground water quality from changing sufficiently to reverse the t-test conclusion in the short period of time since the assessment.

In addition, the assessment was accepted by IEPA in March but not until July by USEPA, and therefore, we are uncertain which date was to be used for the six month period to perform the t-test analysis. The negotiations for an improved monitoring system were targeted, by us, to be completed prior to this date.

We have been negotiating in good faith with IEPA and USEPA to develop a technically sound monitoring program which meets the regulatory framework of both agencies and which addresses the unique ground water situation at the incinerator as a result of regional ground water issues. The progress in those negotiations was negated at the noted meeting with the opinion of IEPA that the site should re-enter assessment monitoring. Due to conflicting correspondence and positions of the two agencies we believe a reassessment is not warranted at this time. In a desire to avoid further conflicting requirements, we are submitting this notice and assessment plan though we are not conceding that this submittal is required by state or federal regulations.

A ground water assessment will be conducted using existing monitoring wells, since the number, location, and depth were deemed adequate by both agencies and our hydrogeological consultant (Golder Associates). The well logs and site drawings are currently on file with both IEPA and USEPA. Refer to Assessment No. 1 (Golder Summary Report, June '86) for background information. We will provide additional copies, if requested.

Page -2-  
Ltr to R. Carlson  
10/21/86

The sampling and analytical methods utilized for the previous assessment for 40 CFR Appendix III, Table 1, and Appendix VII parameters will be used. Dioxin and furan isomers will not be analyzed since the site does not accept these materials.

The ground water evaluation will be based upon the following steps:

- 1) Sampling of the impoundments for Appendix III & VII constituents, excluding dioxin and furans.
- 2) Resample to verify elevated or suspect parameters, if required for confirmation.
- 3) Select primary parameters for well sampling based on observed concentrations exceeding quantification limits.
- 4) Sampling of wells (G110, G111A, G112B, G113, 120S, 121S, 122S, 123S, 124S, 125S) for primary parameters.
- 5) Evaluate data using tolerance interval statistical procedures. Specific statistical models and methodology will be selected as appropriate to each set of data. The statistical tolerance interval methodology is based upon the selection of a statistical model e.g., lognormal, delta, Gaussian, etc., which fits the specific data base under evaluation, e.g., heavy metals or inorganics, organics, or pH. This approach has been discussed with IEPA and USEPA in previous meetings. A tolerance interval is calculated for each data set, with an upper tolerance limit and a lower tolerance limit. The tolerance limit is that value, above which, the measured concentration is due to a source other than random analytical results. See attached information for more detailed discussion of the statistical procedure. Also, attached is a letter from Mr. R. Gibbons, consulting statistician, confirming his discussion with Mr. Barnes Johnson, USEPA statistician, that the tolerance interval methodology is appropriate for the Chicago Incinerator facility.
- 6) If the results of the statistical evaluation indicate that the upper tolerance interval has been exceeded, the site will perform confirmatory monitoring which will include:
  - definition of the rate and extent of contaminant migration, if any;

Page -3-  
 Ltr to R. Carlson  
 10/21/86

- evaluation of chemical constituent patterns in the impoundments versus those found in the wells;
  - ascertain if the regulated units are the source of the contamination, if any;
  - if the source is the regulated unit, conduct a study to define the appropriate action;
  - if the source is not from the regulated units, return to base-line monitoring (see below) and evaluate further action.
- 7) If the results of the statistical evaluation indicate that the lower tolerance limit has not been exceeded, the site will continue to perform base-line monitoring on a quarterly basis for the selected parameters in the wells noted in #4.
- 8) If the results of the statistical evaluation are indeterminant, the site will perform verification monitoring. This will include analysis of additional, secondary parameters. Trend analyses will be performed on the data after four quarters to determine if the concentrations are increasing or decreasing. The site will then proceed to either base-line monitoring or confirmatory monitoring, dependent upon the trend analysis results.
- 9) The site will continue in this monitoring program until either the impoundments are closed or until a Part B permit is issued.

The assessment will be conducted per the following schedule:

<u>ITEM</u>	<u>SCHEDULE</u>	<u>COMMENTS</u>
• Initiate sampling	- 2 weeks	After IEPA & USEPA's concurrence of plan.
• Sampling impoundment & analyses	- 80-100 days	Lab turn-around 50-70 days
• Resample, if required	- 80-100 days	" " " "
• Select parameters, prepare report, submit to IEPA/USEPA for concurrence	- 30-40 days	
IEPA/USEPA concurrence	- Unknown	
• Sample Wells	- 80-100 days	" " " "

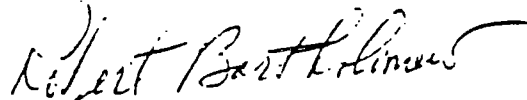
Page -4-  
Ltr. to R. Carlson  
10/21/86

<u>ITEM</u>	<u>SCHEDULE</u>	<u>COMMENT</u>
• Resample, if required	- 80-100 days	" " " "
• Evaluate data	- 30-40 days	
• Determine rate & extent of migration, if required-	40-60 days	Consultant to prepare
• Prepare & submit final report	- 20-30 days	

The above plan was prepared in conjunction with Golder Associates. Since all of the hydrogeological background data and well information is unchanged from the previous assessment, no additional presentation is included herein. If it is necessary to determine the rate and extent of migration, a qualified hydrogeologist will perform the work.

This assessment will be initiated upon concurrence of the program by IEPA and USEPA.

Very truly yours,  
SCA CHEMICAL SERVICES



Robert Bartholomew  
Mgr. Health, Safety &  
Environmental Compliance

RB/rh  
encls.

cc: V. Adamkus  
B. Child  
B. Munro

**APPENDIX B**  
**DETAILS OF RCRA MONITORING WELL SYSTEM**

**August 1987**

**873-2096**

**Golder Associates**



DR. LAWRENCE A. DuBOSE, president  
CHARLES C. LUTHER, vice-president  
LYLE E. THOMPSON, vice-president  
NOBLE D. MORAN, vice-president  
BRUCE POYNOR, engineering geologist

TESTING SERVICE CORPORATION

457 East Gundersen Drive, Carol Stream, Illinois 60187 - 2492

Telephone: 653-3920 Area Code 312

consultation services  
foundation & site exploration  
testing of soils, concrete &  
bituminous materials

June 24, 1982

SCA SERVICES, INC.  
11700 South Stony Island Avenue  
Chicago, Illinois 60617

L - 18,901-A

RE: Installation of Monitoring Wells  
11700 South Stony Island Avenue  
Chicago, Illinois

Attention: Mr. Arthur Quaglieri

Gentlemen:

On June 23, 1982 we installed 3 additional monitoring wells (G-112B, G-113A, G-118A) in connection with the above referenced site. Monitoring Well G-112B replaced G-112A which had been recently damaged.

The following table summarizes the installation and water table data for the above 3 wells and for the 4 wells installed earlier in June, 1982.

MONITORING WELL	DEPTH TO BOTTOM * OF WELL SCREEN	DEPTH AT WHICH WATER WAS * ENCOUNTERED DURING DRILLING
G-112B	13.0'	10.5'
G-113A	13.5'	9.5'
G-118A	13.5'	9.0'
G-101A	12.5'	10.0'
G-111A	11.75'	9.25'
G-112A	13.5'	12.0'
G-117A	10.5'	8.0'

\* Depth referenced to ground surface.

The monitoring wells consist of 2" PVC pipe with a 5.0' section of PVC screen having No. 10 slots (slot opening 0.010 inch). All of the PVC pipe used was of the threaded flush-joint type. No glue or cement was used. A steel protective pipe with a hinged lid and locking device were concreted into place over the PVC pipe. Individual bailers with nylon rope were suspended in each well.



**APPENDIX C**  
**DETAILS OF ASSESSMENT WELL INSTALLATIONS**

**August 1987**

**873-2096**

**Golder Associates**

Figure 3

BORING LOG <u>G-120 (P and S)</u> SHEET <u>1</u> OF <u>1</u>									
SURFACE ELEV. <u>12.4 Feet</u>		PROJECT <u>SCA Incinerator, Chicago, Illinois</u>							
DATUM <u>Chicago City Datum</u>		DATE STARTED <u>10/11 (P) &amp; 23 (S)</u>				DATE COMPLETED <u>10/11 (P) &amp; 23 (S)</u>			
DRILL RIG <u>Mobile B-61</u>		DRILLING METHOD <u>Hollow Stem Auger (3½" ID, 7" OD)</u>							
ELEV. DEPTH	DESCRIPTION	UNIFIED CLASS.	BLOWS/FOOT	SAMPLES				REMARKS	
				NUMBER	TYPE	HAMMER BLOWS PER 6 IN.	REC./ATT. (in.)		
2	Firm to stiff, brown, silty clay <u>FILL</u> mixed with misc. debris (wood, brick, steel, concrete) (CL)							Boring G-120 P initially augered to 13 ft, refusal on concrete, drilled new hole + 10 ft south of original location. Boring G-120 S is located + 3 ft north of G-120 P, no sampling was performed. See text for well completion procedures. See Figures 9 and 10 for well completion details.	
4									
6			16	1	SS	6-10-refusal	9/12		
8			7	2	SS	1-2-5	16/18		
10			24	3	SS	7-6-18	14/18		
12									
14	Stiff, black, silty clay <u>FILL</u> mixed with misc. debris (CL)		11	4	SS	2-3-8	2/18		
16	Soft, black, silty clay <u>FILL</u> , wet (CL)		4	5	SS	1-1-3	2/18		
18	Stiff, gray, silty <u>CLAY</u> , trace of sand and fine gravel (CL-CH)		10	6	SS	2-4-6	12/18		
20	Boring G-120 P completed at 19 ft 6 in. BGS on 10/11/85. Augers advanced to 19 ft 3 in. BGS to install PVC well casing. Boring G-120 S completed at 18 ft 7 in. BGS on 10/23/85. Ground water encountered at + 15 ft BGS, but stabilized to + 8 ft BGS upon completion of each well.								

Job No. 853-2054  
 Scale 1" = 4'

Golder Associates

Drawn DLO  
 Checked Wm

Figure 4

BORING LOG G-121 (P and S)SHEET 1 OF 1SURFACE ELEV. 12.4 FeetPROJECT SCA Incinerator, Chicago, IllinoisDATUM Chicago City DatumDATE STARTED 10/14 (P) & 24 (S) DATE COMPLETED 10/15 (P) & 24 (S)DRILL RIG Mobile E-61DRILLING METHOD Hollow Stem Auger (3½" ID, 7" OD)

ELEV. DEPTH	DESCRIPTION	UNIFIED CLASS.	BLOWS/FOOT	SAMPLES				REMARKS
				NUMBER	TYPE	HAMMER BLOWS PER 6 IN.	REC./ATT. (in.)	
2	Medium dense, black, misc. <u>FILL</u> (asphalt, brick, concrete, gravel, etc.)							Both borings (P and S) were augered without difficulty. G-120 S was drilled + 3 ft east of G-120 P. No sampling was performed for G-120 S. See text for well completion procedures. See Figures 11 and 12 for well completion details.
4								
6			19	1	SS	9-9-10	8/18	
8	Soft, black, oily sludge and misc. <u>FILL</u> , wet		24	2	SS	2-3-21	8/18	
10			3	3	SS	1-1-2	14/18	
12	Soft, brown and gray, silty clay <u>FILL</u> (CL-CH)							
14			5	4	SS	2-3-2	14/18	
16	Soft, black, oily sludge <u>FILL</u>							
18			10	5	SS	3-6-4	14/18	
20	Firm, gray, silty <u>CLAY</u> , trace of sand and fine gravel (CL-CH)							
	Boring G-121 P completed at 17 ft BGS on 10/15/85. Boring G-121 S completed at 18 ft 6 in. BGS on 10/24/85. Ground water encountered at ± 7 ft BGS in both borings.							

Job No. 853-2054  
Scale 1" = 4'

Golder Associates

Drawn DLO  
Checked WML

BORING LOG G-123 SSHEET 1 OF 1SURFACE ELEV. 12.4 FeetPROJECT SCA Incinerator, Chicago, IllinoisDATUM Chicago City DatumDATE STARTED 10/16/85DATE COMPLETED 10/17/85DRILL RIG Mobile B-61DRILLING METHOD Hollow Stem Auger (3½" ID, 7" OD)

ELEV. DEPTH	DESCRIPTION	UNIFIED CLASS	BLOWS/FOOT	SAMPLES				REMARKS
				NUMBER	TYPE	HAMMER BLOWS PER 6 IN.	REC./ATT. (in.)	
2	Firm to very stiff, black, misc. <u>FILL</u> (brick, concrete, sand, clay, etc.)							Initial boring was augered to refusal at 10 ft depth. Augered new hole 10 ft west of original location without any difficulty to a depth of 18 ft 3 in. See text for well completion procedures. See Figure 15 for well completion details.
4								
6			26	1	SS	7-11-15	8/18	
8	Wet at 8 ft depth		7	2	SS	5-3-4	8/18	
10								
12	Firm, gray, gravelly clay <u>FILL</u>		6	3	SS	2-2-4	10/18	
14	Stiff, gray and black, silty clay <u>FILL</u> , wet		14	4	SS	6-6-6	18/18	
16	Grading soft at 16 ft		5	5	SS	2-3-2	18/18	
18	Soft, gray, silty <u>CLAY</u> , trace sand and fine gravel (CL-CH)							
20	Boring completed at 18 ft 3 in. BGS on 10/17/85. Ground water encountered at + 8 ft BGS, but stabilized at + 4 ft BGS upon completion of well.							

Job No. 853-2054Scale 1" = 4'

Golder Associates

Drawn DLOChecked lrmu

BORING LOG G-125 (P and S)SHEET 1 OF 1SURFACE ELEV. 12.0 FeetPROJECT SCA Incinerator, Chicago, IllinoisDATUM Chicago City DatumDATE STARTED 10/15 (P) & 23 (S) DATE COMPLETED 10/15 (P) & 23(S)DRILL RIG Mobile B-61DRILLING METHOD Hollow Stem Auger (3½" ID, 7" OD)

ELEV. DEPTH	DESCRIPTION	UNIFIED CLASS.	BLOWS/FOOT	SAMPLES				REMARKS
				NUMBER	TYPE	HAMMER BLOWS PER 6 IN.	REC./ATT. (in.)	
2	Medium dense, black, sandy, misc. <u>FILL</u> (brick, wood, concrete, etc.)							Both borings were augered to final depth with little difficulty. Boring G-125 S augered through two concrete chunks at 7 ft and 10 ft depths. Boring G-125 S is located + 4 ft east of G-125 P. No sampling was performed for G-125 S. See text for well completion procedures. See Figure 17 and 18 for well completion details.
4								
6			30	1	SS	10-12-18	8/18	
8			12	2	SS	2-3-9	8/18	
10	Soft to firm, gray, brown and black, silty clay <u>FILL</u> , moist (CL-CH)		5	3	SS	2-2-3	8/18	
12								
14			3	4	SS	1-1-2	8/18	
16			5	5	SS	1-2-3	8/18	
18	Stiff, gray, silty <u>CLAY</u> , trace sand and fine gravel (CL-CH)		11	6	SS	2-4-7	14/18	
20	Boring G-125 P augered to 18 ft 9 in. BGS on 10/15/85. Boring G-125 S completed at 18 ft 6 in. BGS on 10/23/85. Ground water was difficult to detect (no obvious zone of infiltration). Ground water stabilized previous day in completed wells at + 9 ft BGS.							

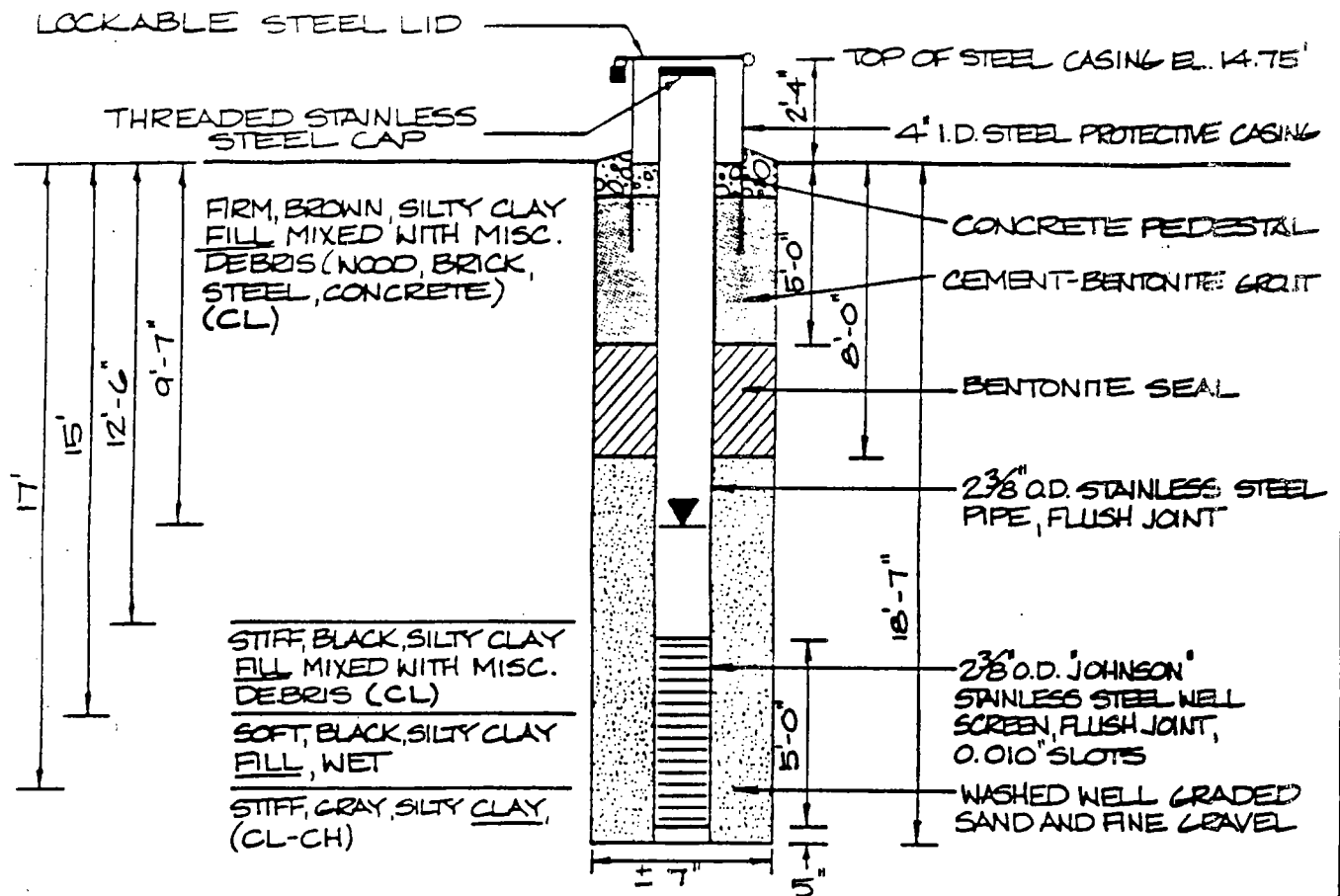
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Golder Associates

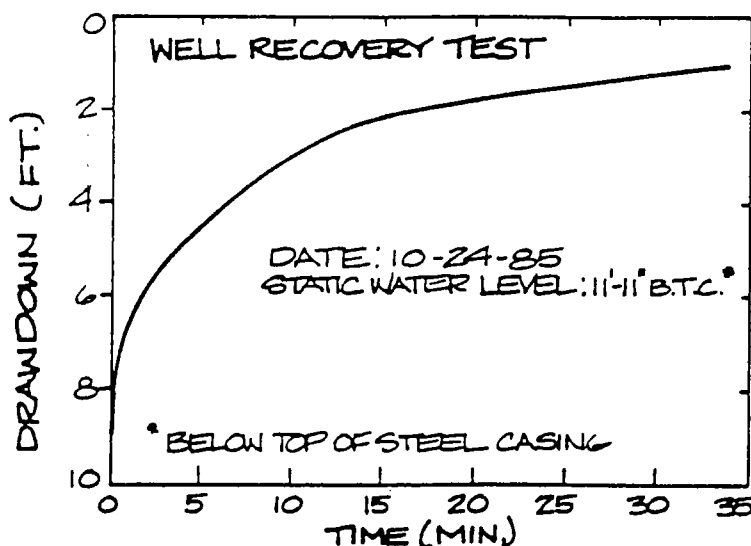
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# COMPLETION DETAIL WELL G-120S

FIGURE 9



SCALE: VERT. 1" = 5'  
HORIZ. N.T.S.



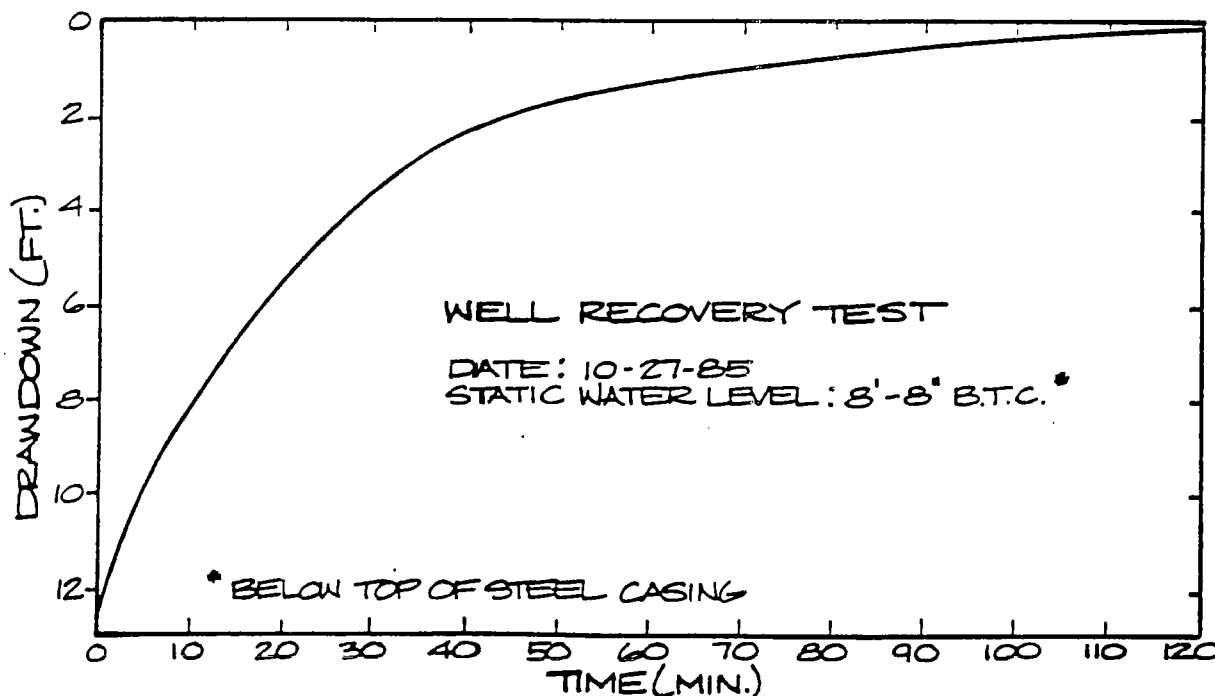
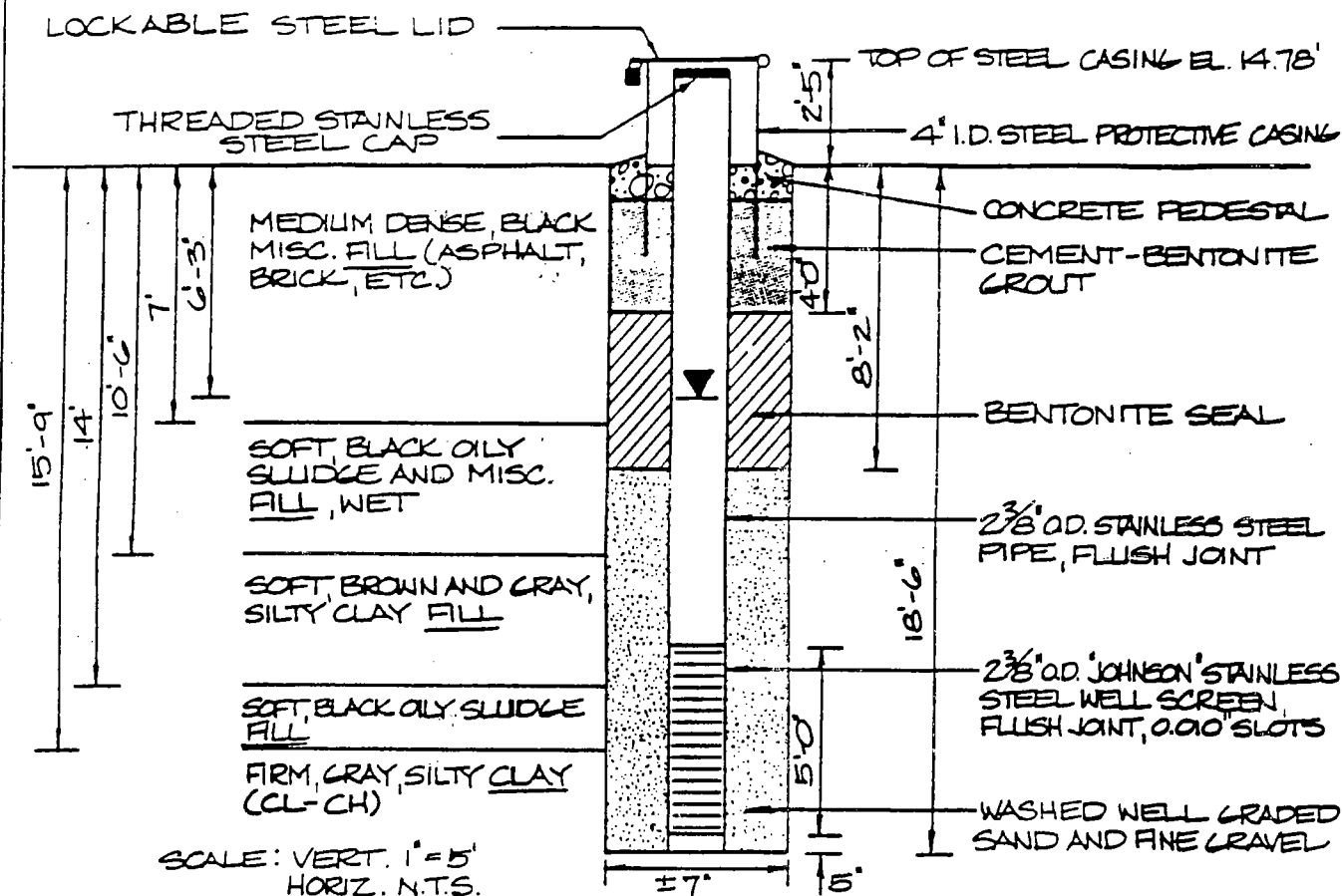
NOTES: WELL DEVELOPED BY BAILING WITH A STAINLESS STEEL BAILER ON OCT. 24, 25, 26 AND 27. TOTAL VOLUME OF WATER REMOVED = 18 GALLONS

## GROUND WATER QUALITY DATA

DATE: 10-25-85  
TEMPERATURE: 16°C  
CONDUCTIVITY: 1250  $\mu$ mhos/cm

# COMPLETION DETAIL WELL G-121S

FIGURE 11



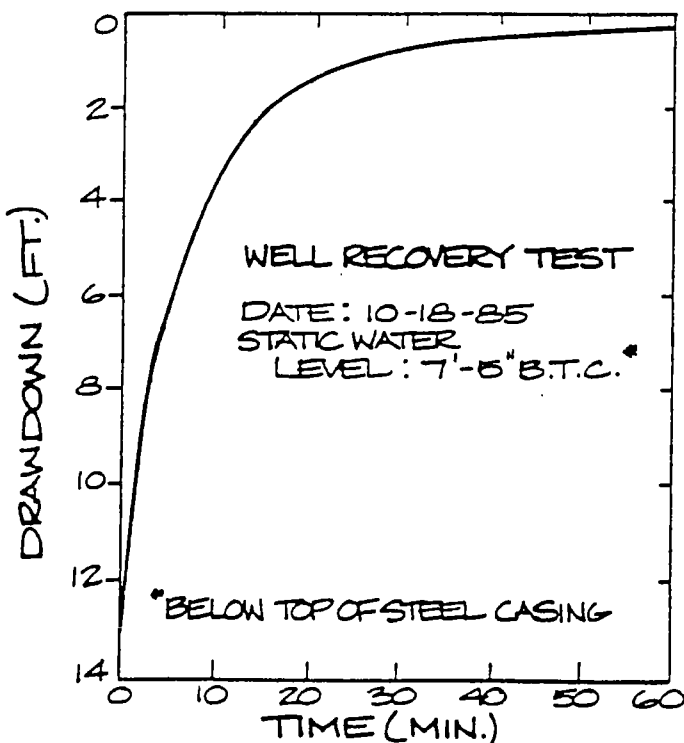
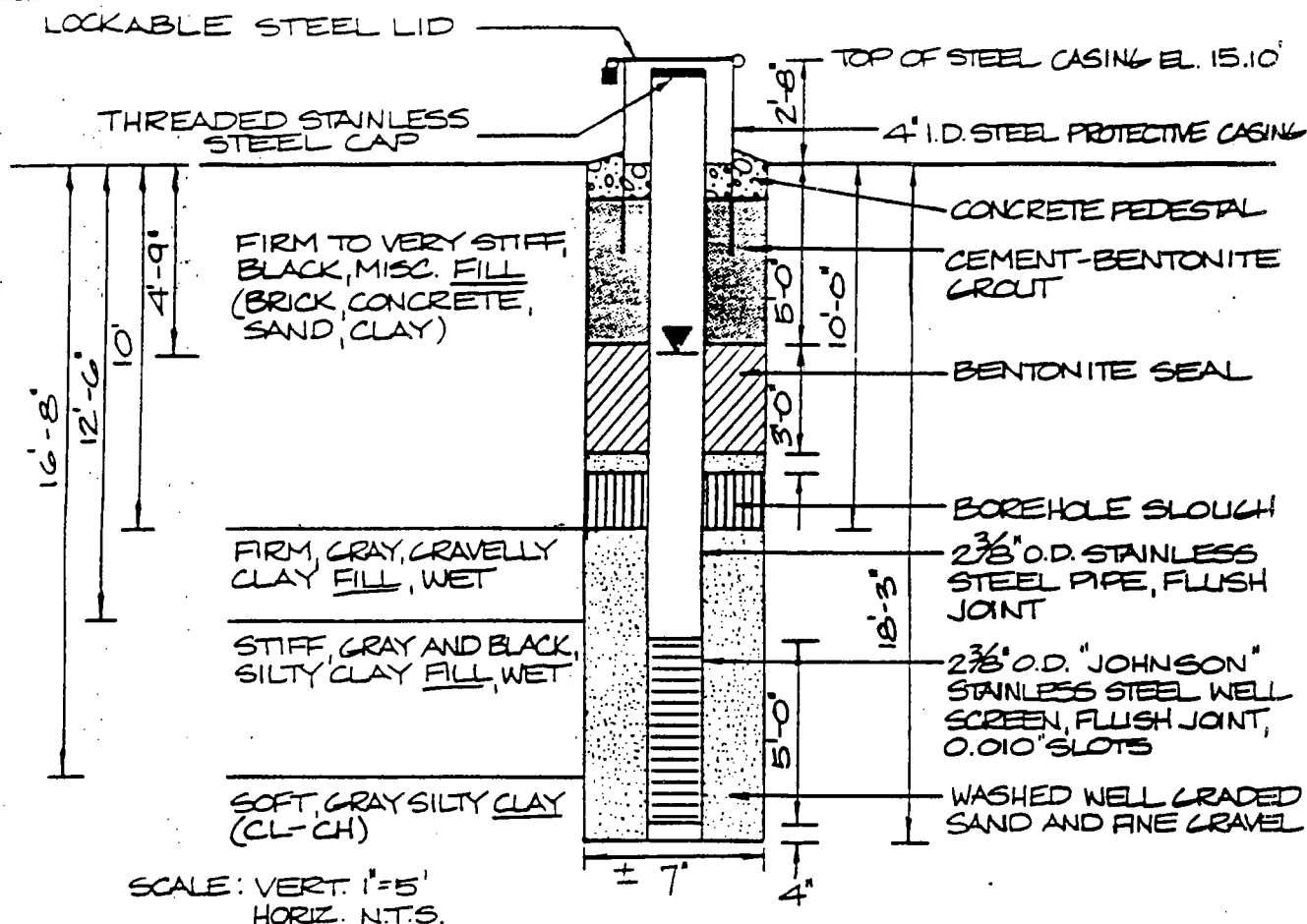
## GROUND WATER QUALITY

DATE: 10-25-85  
TEMPERATURE: 16°C  
CONDUCTIVITY: 15,500  $\mu$ mhos/cm

NOTE: (1) WELL DEVELOPED BY BAILING ON OCTOBER 25, 26 AND 27, TOTAL VOLUME REMOVED = 18 GALLONS

# COMPLETION DETAIL WELL G-123S

FIGURE 15



## GROUND WATER QUALITY

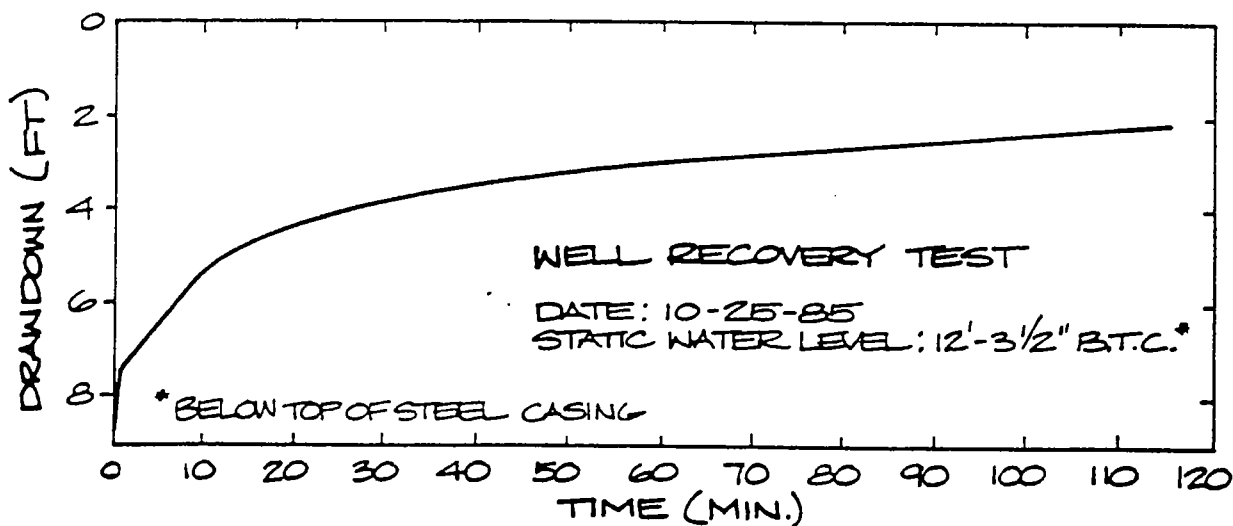
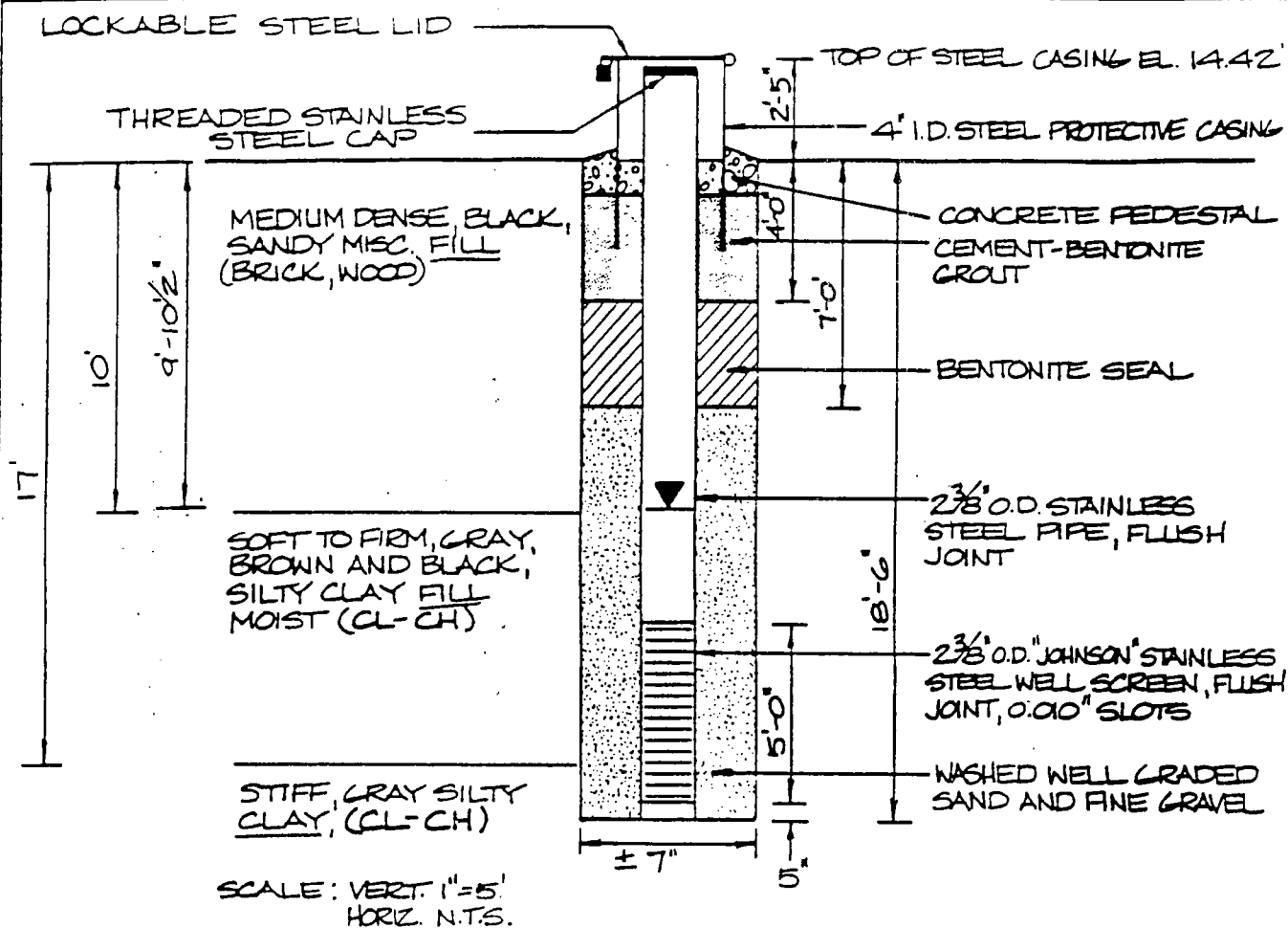
DATE: 10-22-85  
TEMPERATURE: 19°C  
CONDUCTIVITY: 5,100  $\mu$ mhos/cm

NOTE: WELL DEVELOPED BY BAILING ON OCTOBER 18, 21 AND 22. TOTAL VOLUME REMOVED = 107 GALLONS



# COMPLETION DETAIL WELL G-125S

FIGURE 17



## GROUND WATER QUALITY

DATE: 10-25-85  
TEMPERATURE: 19°C  
CONDUCTIVITY: 2000  $\mu$ mhos/cm

NOTE: (1) WELL DEVELOPED BY BAILING ON OCTOBER 24, 25, 26 AND 27. TOTAL VOLUME REMOVED = 17 GALLONS.

**APPENDIX D**

**WASTE MANAGEMENT INC. GROUND-WATER SAMPLING MANUAL**

**August 1987**

**873-2096**

**Golder Associates**

Revised 9/86



WMI MANUAL  
FOR  
GROUNDWATER SAMPLING

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3003 Butterfield Road  
Oak Brook, Illinois 60521

Revised 9/86

## 1.0 INTRODUCTION

## 1.0 INTRODUCTION

### 1.1 WMI Groundwater Monitoring Program - Overview

The objective of the WMI Groundwater Monitoring Program is to determine to what extent a waste facility is impacting the groundwater. Federal, state, and local regulatory bodies have established criteria that must be met for a facility to continue operating. These criteria involve standards that the groundwater must meet with respect to the levels of chemical constituents. Hence, a groundwater monitoring program is required at all WMI facilities.

Regulations seldom specify the methodologies required to carry out a comprehensive groundwater monitoring program; therefore, Waste Management, Inc., through its Environmental Management Division and through many years of experience, has set up a groundwater monitoring program that WMI believes provides the most accurate data possible. This manual provides the procedures necessary to carry out the first and most critical element in the groundwater monitoring program--the sampling. Other elements of the groundwater monitoring program can be found in the Site Specific Groundwater Monitoring Plans. The WMI Groundwater Monitoring Program's structure is given schematically in Figure 1.1.

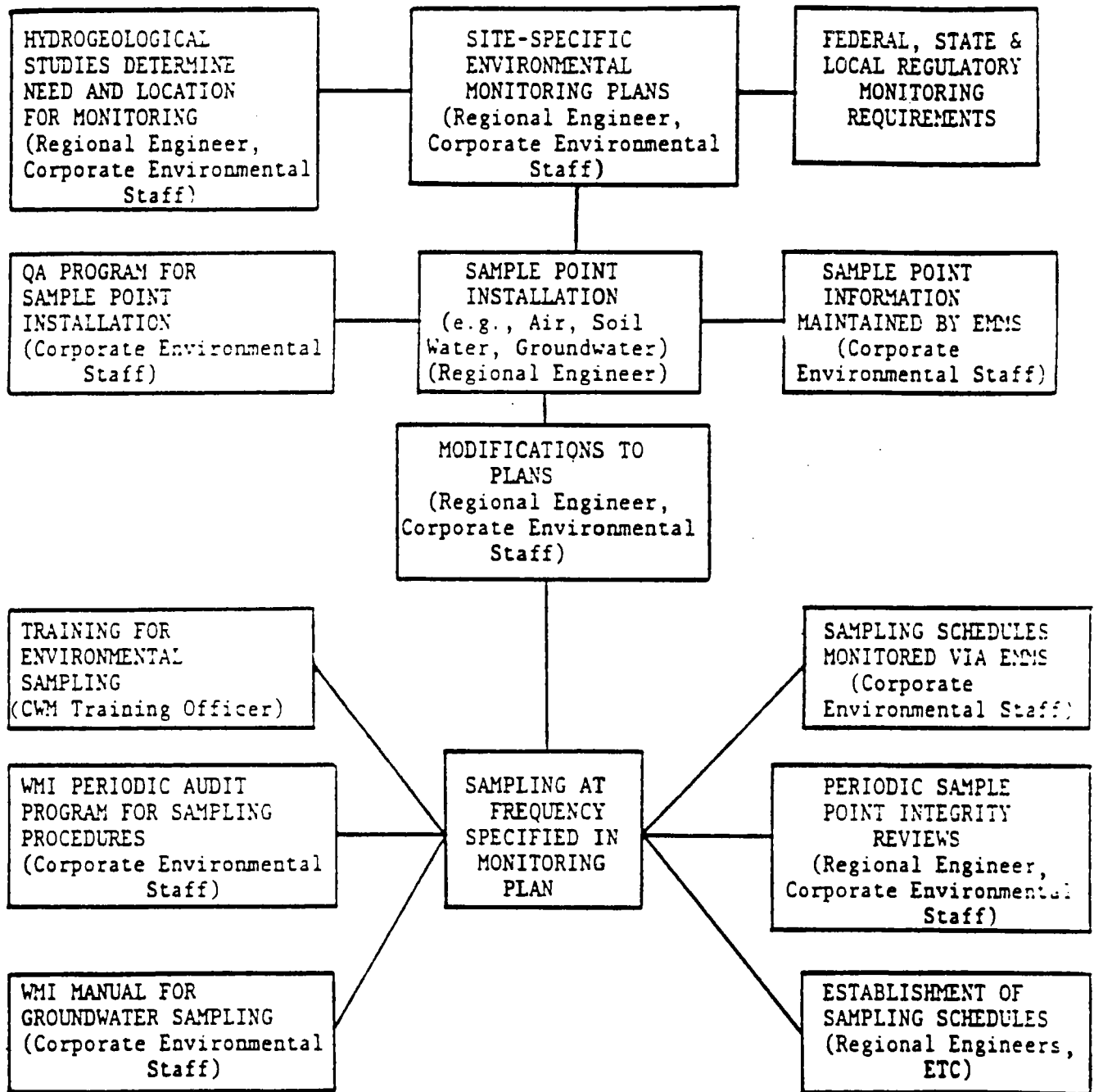
The Site-Specific Environmental Monitoring Plans are developed by the Regional Engineers, with the assistance of the Corporate Environmental Staff. The plans include information regarding federal, state, and local regulatory monitoring requirements, as well as hydrogeological information. These plans and the site-specific hydrogeological studies determine the need for and location of sample collection points.

WMI recognizes that sampling is a critical step for an effective monitoring program and therefore has incorporated both the WMI Manual for Groundwater Sampling and the Site Specific Environmental Monitoring Plan into the Policies and Procedures (PAP) of Waste

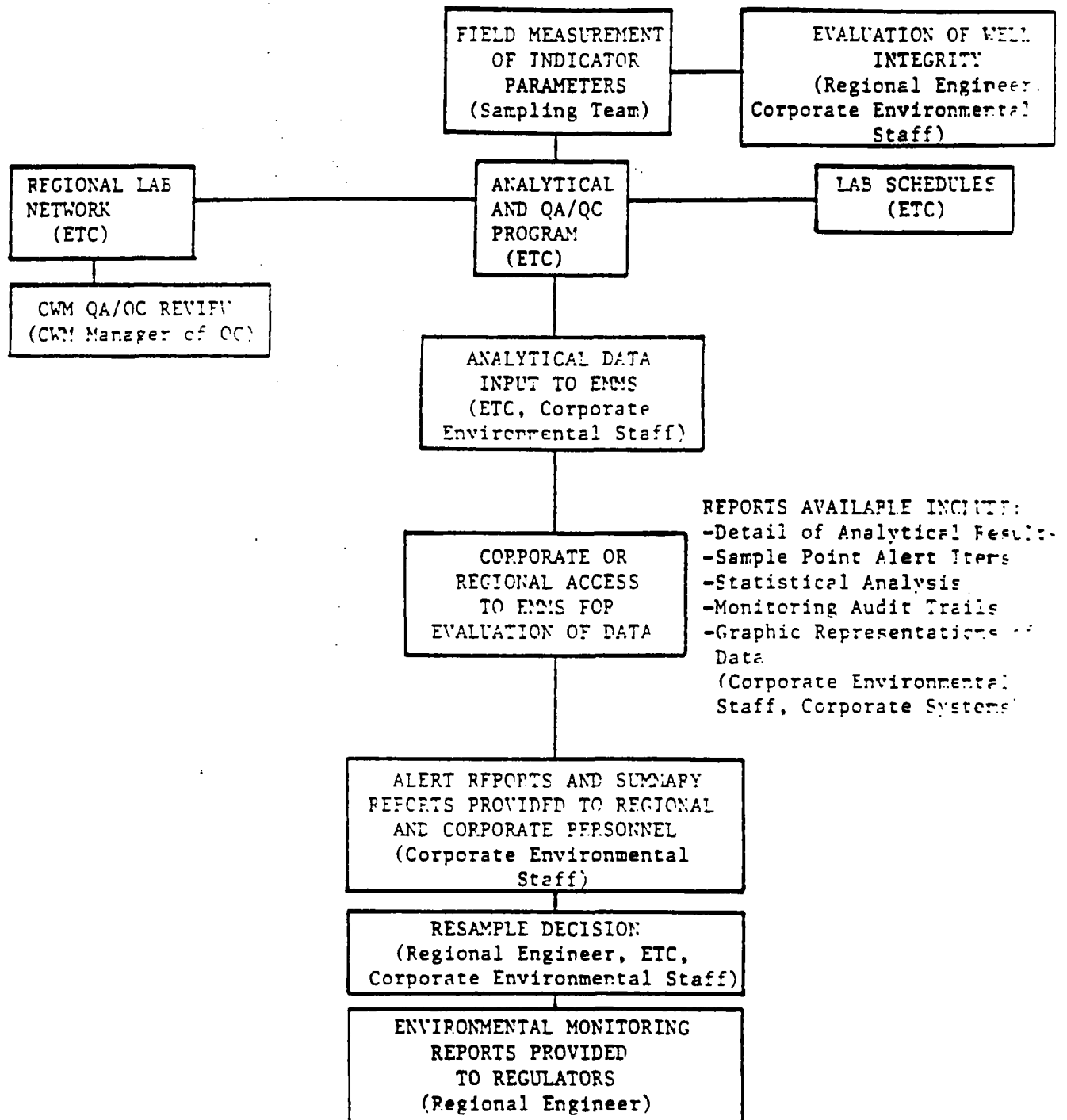
Management, Inc. The PAP is the framework of Waste Management's regulations and requirements at each facility. By incorporating both of these manuals into the PAP, all activities related to groundwater monitoring will be continually reviewed and scrutinized for its completeness and integrity. As you know, the sampling team's performance is an integral part of the sampling event; therefore, formalized training and periodic audits of the sampling procedures will be performed to ensure the integrity. Groundwater samples are collected by consultants or WMI site personnel at a frequency specified in the monitoring plans. The WMI Manual for Groundwater Sampling has been developed for the use by WMI site personnel and consultants.

The analytical program is managed by WMI-EMD, through Environmental Testing and Certification Corporation (ETC). ETC is responsible for ensuring the quality of the analytical data. ETC has established a network of regional laboratories to perform the bulk of conventional analyses. The program provides the necessary analytical results for all groundwater sampling points. The analytical data is entered into the Environmental Management Monitoring System (EMMS) by ETC via computer data transfer, and is available for the retrieval of data by corporate and regional personnel via EMMS terminals. Hard copies of the data also are provided to the Corporate and Regional EMD staff by ETC for submittal of results to the regulatory agencies. Various data report formats and graphic representations of data are available from EMMS (refer to the EMMS Manual for list of available reports).

Figure 1.1

ENVIRONMENTAL MONITORING PROGRAM STRUCTURE AND RESPONSIBILITIES

ENVIRONMENTAL MONITORING PROGRAM STRUCTURE AND RESPONSIBILITIES



NOTE: Personnel, as listed in parentheses, may be found in Appendix.



## 1.2 WMI Sampling Program

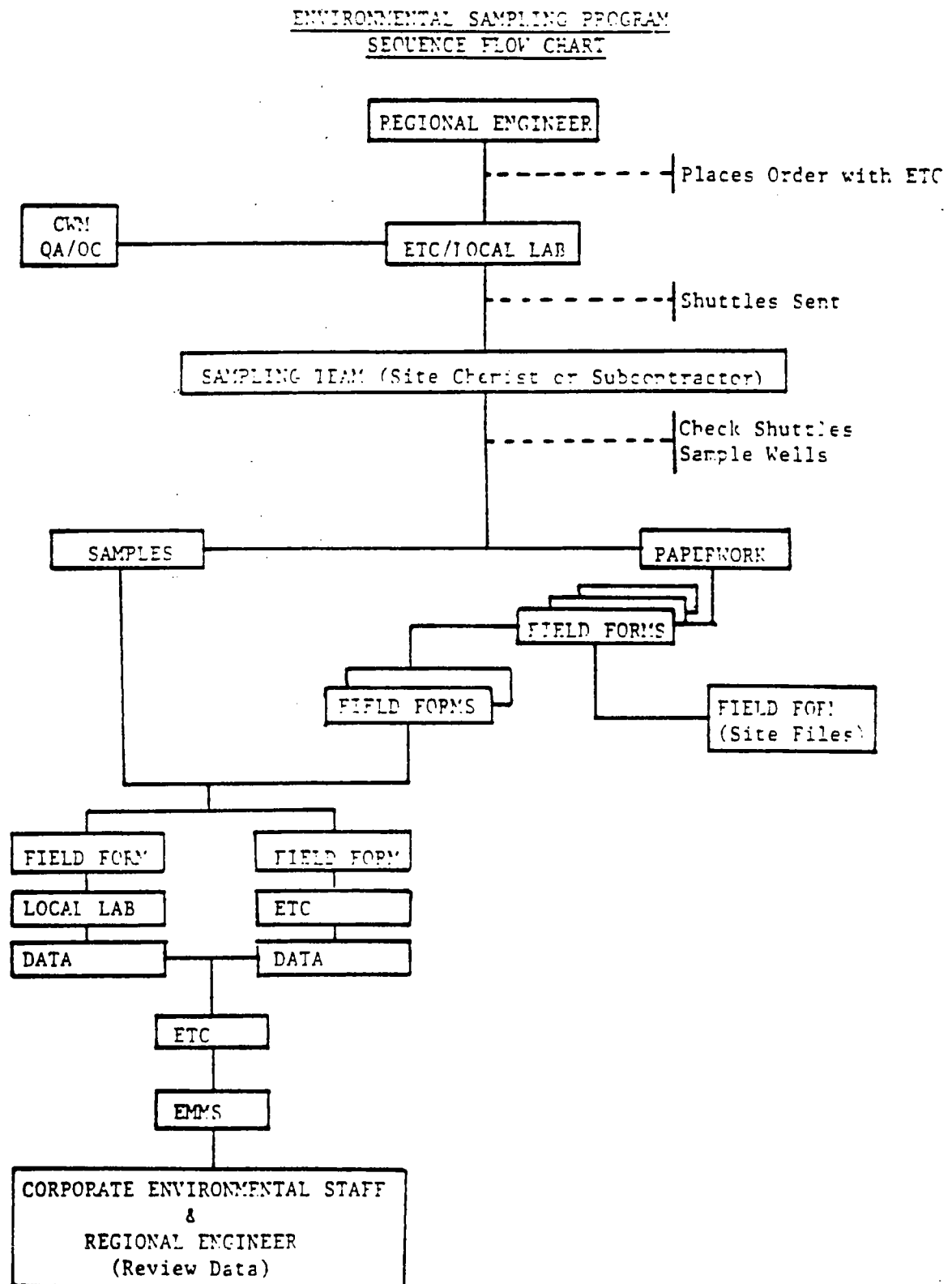
The WMI Sampling Program is just a part of the overall WMI Groundwater Monitoring Program, and utilizes this Manual for Groundwater Sampling to define the procedures used in the program. The WMI Sampling Program is outlined in Figure 1.2. The program begins and ends with the Regional Engineers who act as administrators for their respective regions. The Regional Engineers begin the sampling process by defining the monitoring program with ETC and confirming orders prior to each sample event.

Sample shuttles are sent by ETC or the Regional Lab to the Sampling Team (Site Chemist or Subcontractor) and the condition of the shuttle contents, prior to sampling, is checked. Any problems such as missing bottles, incorrect configuration, etc., must be reported to ETC immediately so that corrective action can be taken. The sample points are then sampled by the sampling team. The Corporate Environmental Staff will make periodic audits to insure compliance.

Field forms are used to document each sampling event. The field forms are sent with the samples to the lab. Copies of all forms must be maintained in the site files.

All samples are sent to ETC or to the Local Lab for analysis. The analytical data and field forms are sent from the Local Lab to ETC, where they are incorporated into a complete data package for each sample point. This data is then sent to the Regional Engineer and the Corporate Environmental Staff for review before being distributed to any regulatory agencies. Simultaneously, data is transferred via magnetic tape to the Corporate EMMS system.

Figure 1.1



2.0 RESPONSIBILITIES OF THE SAMPLING TEAM MEMBERS

## 2.0 RESPONSIBILITIES OF THE SAMPLING TEAM MEMBERS

### Regional Engineer or District Engineer

- \* Provide site specific information for the Groundwater Monitoring Program.
- \* Set up sampling program that complies with Regulations and Corporate policy and obtain approval of Manager of Environmental Monitoring for any changes before they are implemented.
- \* Notify ETC of any changes in sampling schedules or parameters, and confirm dates that shuttles will be sent to the sites.
- \* Work with ETC to set up contract addenda and approve invoices.
- \* Notify Site Manager of maintenance required on wells or necessary replacement equipment.
- \* Review analytical results and submit to proper agencies.
- \* Provide information for Well ID Charts.
- \* Oversee QA/QC of well drilling procedures, and oversee hydrogeological studies at the site.

### Site Manager

- \* Insure adequate well protection.
- \* Make sure that all wells are accessible.
- \* Provide maintenance for the wells where required, or as notified by the Regional or District Engineer.
- \* Include sampling team's performance in annual appraisals (WMI personnel only).
- \* Provide isolated work area for sample prep and equipment storage.
- \* At WMI sites, will be the "keeper of the keys" for the monitoring wells (unless a designee has been assigned).

### Sampling Team Leader

- \* Contact courier for sample pick-up.
- \* Notify ETC, by job number, as to dates samples should arrive and the number of samples.
- \* Call ETC to verify arrival condition of samples, and initiate corrective action if required.

- \* At CWM Sites, the Site Chemist, or designee, will be the "keeper of the keys" for the monitoring wells. It will be his/her responsibility for protecting and limiting access to the wells.

#### Sampling Team Member

- \* Follow all procedures in this manual to prevent contamination of samples and wells.
- \* Obtain, maintain, and inspect all required equipment.
- \* Have spare parts available for all equipment.
- \* Examine shuttles, bottles, and preservatives.
- \* Notify supervisor immediately if any problems are found.
- \* Place ice packs in freezer upon receipt of shuttle.
- \* Assume responsibility for storage of shuttles and sampling equipment.
- \* Calibrate equipment.
- \* Take all field measurements including pH, temperature, and specific conductivity.
- \* Determine if water volume is adequate for all samples.
- \* Purge and sample wells.
- \* Prepare field blanks.
- \* Filter and preserve samples.
- \* Check that samples are correctly identified and packed securely with ice packs in shuttle.
- \* Complete Field Parameter Form and Chain-of-Custody Form and enclose in shuttles.

NOTE: CWM/WMI personnel who participate in sampling will have their performance reviewed as part of the Annual Performance Appraisal. These appraisals will be based upon each team member's performance in carrying out his/her responsibilities.

#### Trainers

- \* Instruct in use of Chain-of-Custody and Field Parameter forms.
- \* Explain procedures to place an order and use the check list.

- \* Explain use of shuttles:
  - contents
  - inspection
  - transportation
  - storage
- \* Explain importance of maintaining contact with the lab.
- \* Explain sample management:
  - the use of preservatives
  - temperature control
  - sample splits
  - shipping samples to the lab
  - blanks
  - sample code numbers
- \* Specify lab receipt procedures.
- \* Instruct sampling team members in procedures for:
  - purging
  - sampling
  - filtering
  - obtaining field data
  - shipping samples
- \* Describe site/well information required for sampling.
- \* Describe and demonstrate the calibration and use of the required equipment.

ETC

- \* Establish and serve as prime contractor for a network of local labs.
- \* Provide all analytical services in conjunction with local labs.
- \* Conduct quarterly audits of subcontract labs.
- \* Assist in selection of subcontract samplers.
- \* Provide a summary level data base, including all analytical results, field measurements, and selected field data.
- \* Insure that all analytical data are supported by permanent records of lab QA/QC procedures, raw data, chain-of-custody, etc.
- \* Assist in organization and documentation of the monitoring program at each site in conjunction with the Regional Engineer.
- \* Provide shuttles.

A complete list of contacts, including phone numbers and addresses, is listed in the Appendix.

### 3.0 PROCEDURES

#### 3.1 Preliminary Procedures

Prior to any sampling at a facility, a number of preliminary tasks must be accomplished. These preliminary procedures may be done infrequently; but if done properly the first time, can insure that the subsequent sampling events are carried out smoothly and cost effectively. The tasks include: well location and characteristics, and sampling schedule and parameters to be monitored for.

##### 3.1.1 Well Location and Characteristics

The first step in any monitoring program is installation or location of the monitoring points. Whether a new program is being started or an old one already exists, certain information about the wells is required. A form must be filled out for each sampling point before any monitoring can begin. This form is the "Monitoring Well Information Form". An additional form must be filled out--the Well ID Chart.

##### 3.1.1.1 Monitoring Well Information Form

The Monitoring Well Information Form (Figures 3.1 and 3.1.1) contains pertinent information with respect to a wells' characteristics, including installation dates and location, drilling method, depth, water levels, screened interval, and well log. This data must be available and maintained in the Site Specific Groundwater Monitoring Plan. The Regional Engineer is responsible for obtaining and maintaining this information.

WMI GROUNDWATER MONITORING PROGRAM  
MONITORING WELL INFORMATION FORMField Descriptions

Site: Site name and site number should be entered.

Well Number: The sample point designation should be entered and be the same as used in the EMMS system.

Date Installed: Installation date.

Location: Location relative to site boundaries should be given as well as exact USGS location (e.g., southeast corner).

Drilling Co./:  
Driller Enter the company name and the person supervising the drilling.

Supervising Co.: The name of the geotechnical company responsible for supervising the actual drilling should be entered. All drilling should be witnessed by a geotechnical engineer.

Log By: Enter name of person responsible for logging the well.

Drilling Method: Specify the method used in drilling the well.

Total Depth: Depth of drilling in feet to the nearest tenth of a foot.

Boring Diameter: Boring diameter in inches to the nearest tenth of an inch.

Ground El.: Enter elevation at the bore hole in feet MSL to the nearest hundredth of a foot.

Standpipe El.: The elevation at the top of the PVC casing in feet to the nearest hundredth of a foot MSL.

Casing: Diameter: Diameter in inches to the nearest tenth of an inch.

Length: Length of casing in feet to the nearest tenth of a foot.

Material: Actual material casing is made of (e.g., Schedule 40 PVC)

Screen: Diameter: Diameter in inches to the nearest tenth of an inch.

Length: Length of screened interval in feet to the nearest tenth of a foot.



Slot Size: Width of slots in inches to the nearest thousandth of an inch.

Water Level: Initial: Water level in feet to the nearest tenth of a foot prior to development.

24 hour: Water level after allowing recharge for 24 hours in feet to nearest tenth of a foot.

Other:

Water Levels Are: Note whether water levels are for ground level or in MSL.

Comments: Space is provided for noting anything unusual about the well that should be known.

Description of Screened Interval: Soil description should be noted for various depths through the screened interval. It is particularly important to note soil composition and thickness of the soil strata.

Values Are: Note whether depth from ground surface or elevation MSL.

FIGURE 3.1

## MONITORING WELL INFORMATION FORM

Site: \_\_\_\_\_  
 Well Number: \_\_\_\_\_ Date Installed: \_\_\_\_\_  
 Location: \_\_\_\_\_  
 \_\_\_\_\_  
 Drilling Co./Driller: \_\_\_\_\_  
 \*Supervising Co.: \_\_\_\_\_ Log By: \_\_\_\_\_  
 \*Drilling Method: \_\_\_\_\_ Total Depth: \_\_\_\_\_ Boring Dia: \_\_\_\_\_  
 \*Ground El.: \_\_\_\_\_ Standpipe El.: \_\_\_\_\_  
 \*Casing: Diameter: \_\_\_\_\_ Length: \_\_\_\_\_ Material: \_\_\_\_\_  
 \*Screen: Diameter: \_\_\_\_\_ Length: \_\_\_\_\_ Slot Size: \_\_\_\_\_  
 \*Water Level: Initial: \_\_\_\_\_ 24-hour: \_\_\_\_\_ Other: \_\_\_\_\_  
 (Water levels are: \_\_\_\_\_ depth from ground surface or \_\_\_\_\_ elevation msl)  
 Comments: \_\_\_\_\_  
 \* To be completed with information provided by drilling or supervising company.

Description of Screened Interval

<u>From**</u>	<u>To**</u>	<u>Soil Description</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

\*\*Values are: \_\_\_\_\_ depth from ground surface or \_\_\_\_\_ elevation msl.

FIGURE 3.1.1

Example

## MONITORING WELL INFORMATION FORM

Site: Port Arthur (510)  
 Well Number: MWES12 Date Installed: 10/6/79  
 Location: Southwest corner of eastern sector  
(USGS location should be listed if available)  
 \*Drilling Co./Driller: Ables Drilling Co./R.Ables  
 \*Supervising Co.: Woodward-Clyde Consultant Log By: S. Caronne  
 \*Drilling Method: Rotary Wash Total Depth: 39.0' Boring Dia: 7-1/2"  
 \*Ground El.: 10.88' msl Standpipe El.: 11.08' msl  
 \*Casing: Diameter: 4" Length: 16.4' Material: Sch. 40 PVC  
 \*Screen: Diameter: 4" Length: 20' Slot Size: 0.010"  
 \*Water Level: Initial: \_\_\_\_\_ 24-hour: \_\_\_\_\_ Other: \_\_\_\_\_  
 (Water levels are: \_\_\_\_\_ depth from ground surface or \_\_\_\_\_ elevation msl)  
 Comments: 8" Sch. 40 PVC hole casing to 9.7 ft. depth; 5" steel protective  
casing.  
 \* To be completed with information provided by drilling or supervising  
company.

Description of Screened Interval

<u>From**</u>	<u>To**</u>	<u>Soil Description</u>
<u>-3.8'</u>	<u>-10.4'</u>	<u>gray and brown clay</u>
<u>-10.4'</u>	<u>-23.1'</u>	<u>gray and brown silty sand with clay seams</u>
		<u>(2"-3" thick) at -12.6', -14.6', -16.1', -17.6',</u>
		<u>-19.1', and -20.6'</u>
<u>-23.1'</u>	<u>-23.8'</u>	<u>dark brown clay with bluish gray seams</u>

\*\*Values are: \_\_\_\_\_ depth from ground surface or x elevation msl.

### 3.1.1.2 Well ID Chart

A Well ID Chart (Figures 3.2 and 3.2.1) has been assembled for each WMI site as a reference for the sampling team, and provides a concise summary of general well design and historical information. The historical values in this chart should be compared with the observed values when a sample is taken. If any inconsistent values are observed, complete the sampling and contact the Regional Engineer immediately. Do not discard the sample. A copy of the completed Well ID Chart must be included in this manual.

Information for the chart must be updated as necessary, and must include:

Well ID #: Sample point identification number. (Identification numbers assigned by state or local agencies should be shown in parenthesis).

Active or Closed: (A) if well is active, (C) if the well is closed. Closure date should be noted in the comments section.

Purpose: Note whether the well is a RCRA well, PCB well, etc.

Gradient: Note whether the well is upgradient, downgradient, or lateral.

Depth of Well: Total depth to the bottom of the screen, measured in feet, from the top of the well casing.

Elevation at Top of Casing: Elevation in MSL (mean sea level) measured at the top of the well casing. (If elevations have been measured from another point, this should be noted on the Well ID Chart.)

Normal Ranges: Ranges, chosen by the Regional Engineer, which represent values that are usually found, including seasonal variations. (These are not Alert Levels!)

Purge Volume: Approximate total number of gallons that are purged from the well (3 casing volumes).

Depth to Water: Approximate depth to water, measured in feet, from the top of the well casing.

Recharge Time: Approximate time, in hours, required for the well to recharge sufficiently for sampling.

Temperature: Approximate water temperature in °C.

pH: Approximate pH values of the water, measured in standard pH units.

Specific Conductivity: Approximate specific conductivity values, measured in umhos/cm at 25°C.

Comments: Utilized for noting well closure dates, specific monitoring requirements, zero calibration point for Well Wizards, etc.

A site map, with well locations and ID numbers, is available in the Sites' Groundwater Monitoring Plan, and is available for use by the sampling team members in locating the wells and in positively identifying them.



DATE: 3-10-86

**NORMAL RANGE**

[illegible]

Revised 9/85

### 3.1.2 Sampling Schedules and Parameters

For each site, ETC and the Regional Engineer, or designee, will review site and sampling information, including a schedule, which will be documented on the Site Summary forms. The forms contain a monitoring program description, a schedule and budget, sampling and analysis requirements, and administrative information, e.g., report distribution, shuttle and sample bottle shipment.

The site summary forms become part of an addendum which authorizes the budget for the annual environmental monitoring program. Changes to a sampling project or initiation of an unscheduled special project will require the Regional Engineer, or designee, to modify the addendum and/or Site Summary forms. Prior to each sampling event, the sampling and analysis requirements (Part III) and administrative information (Part IV) must be confirmed or defined.

After confirmation, the Part III forms are used by ETC to confirm orders with the regional labs and to provide instructions to the sampling teams.

### 3.1.3 Confirmation or Initiation of a Sampling Project

For a scheduled sampling event, ETC should be notified a minimum of two weeks prior to sampling. Sample bottles and shuttles are sent via courier, which require approximately 10 days for delivery. For rapid response projects, designated by the Regional Engineers, shuttles and bottles can be sent express (overnite) or delivered by the subcontract lab. To minimize the need for express shipments, a limited amount of sample bottles and supplies will be stored at local labs, or at the site if storage space is available. In case of emergencies, the regional lab may be utilized directly with the approval of the Regional Engineer. However, short notice of a project tends to increase project costs. As much notice as possible should be given on any project.



In confirming a sampling project, reference should be made to the appropriate Part III forms. An example of a Part III form is illustrated in Figure 3.3. Report distribution, report formats, and shuttle shipment arrangements should also be confirmed (Part IV--Figure 3.4). Any changes should be noted verbally and confirmed in writing by sending the corrected forms to ETC.

If the sampling project has not been previously documented, information should be provided to ETC on Part III and IV forms. For rapid response projects, information can be supplied by phone but must be followed in writing on the Site Summary Part III. The information described in the following paragraphs is to be defined in placing an order or in completing the Site Summary forms.

o Facility/Site Code

The facility name and site code must be identified. Results are reported by facility site code and not by facility name for confidentiality purposes. All monitoring data in automated storage in EMMS are filed by this number. All analysis done for WMI by ETC are stored in ETC's system and transferred to EMMS under this code. Site codes are also used on all Chain-of-Custody and Field Parameter forms. If a site is new or is being expanded, a site code must be obtained from the Corporate Environmental Management Staff.

o Monitoring Program Element(s)

For regularly scheduled projects, reference is given to the program element(s) to be included for the sampling project. For unscheduled projects, a program element will be assigned. Generally, all samples which require identical analysis will be grouped under a program element (1A, 1B, 2, 3...).

- o Number of Samples and Matrix

The number of samples to be collected and analyzed including field and trip blanks, sample types and matrices (i.e., water, soil, etc.) are to be defined. It is important to identify samples which may have a complex matrix or potential interferences, such as high sulfide or chloride concentrations. These samples require special cleanup procedures prior to analysis. The categories of matrices are listed in Appendix I.

- o Sample Point IDs

Sample point designations must be standardized to avoid confusion. Sample point designations are to be limited to six characters (alphabetic or numeric). The exact sample point designations established in EMMS are to be used by the sampling crew, by ETC, and by the regional lab. ETC has been instructed not to accept orders for analysis that do not correspond to established sample point identifiers. To establish a new code or modify a code, the Corporate Environmental Staff should be contacted.

In addition, ETC uses a prefix to the sample ID code which identifies the sample type. Sample source codes with the ID Codes are to be used on the Chain-of-Custody. The sample types and associated source codes are listed in Appendix I.

For samples which are field duplicates, the appropriate source code with the ID code is to be used (e.g., X-DUP). The WMI Project Manager will retain the identity of the duplicate sample.

- o Analysis Group

The analysis group is identified with a small letter of the alphabet. This letter assists in differentiating various analysis requirements for the same group of samples or program elements.

For example, analysis group "a" for groundwater samples may represent the quarterly program parameters, and group "b" represents the annual program parameters.

o Sampling Date(s)/Schedule

Specific dates for sample collection are to be scheduled as soon as possible. Anticipated dates for sample shuttle arrival at the labs(s) are identified so that the lab manager may schedule work and reserve lab capacity for the project. Regulatory agencies should also be notified as to scheduled dates.

o Turnaround

Standard turnaround times for analytical results should be within 21 days from receipt of sample by the lab. Exceptions to this may be required for unusual detection limits, odd matrices, special compounds, and Radium 226/228. Express or emergency turnaround, when required, must be identified.

o Parameters to be Analyzed/Reporting Requirements

The parameters to be analyzed are to be listed by sample point. Special detection limits or methodologies required by a regulatory agency must be defined under special instructions.

o Required Sampling Arrangements

The sampling team must be identified for the sampling event. ETC will maintain communications with the persons responsible for sampling throughout the project, i.e., shuttle check, transportation arrangements, etc., and will work with WMI in coordinating sampling schedules. For special projects, specialized expertise or equipment may be required and as much information as possible should be provided for the subcontract sampler.

o Delivery Address for Shuttles and Sample Bottles

The address for delivery of sample bottles may be the regional lab, the sampling subcontractor, the site, or another WMI facility. Specifics should be given for the delivery location including building, room, etc. This will avoid or minimize relocating shuttles/samples bottles for storage. A site contact is also necessary to allow access of the subcontract sampling team to the site, to confirm arrival of sample bottles, etc.

o Special Comments

Special instructions must also be noted. For example:

1. For rapid response projects, frozen ice packs may be received with delivery of the shuttles to the site. This must be specified;
2. Special packing requirements should be noted, e.g., bottles required for splits;
3. Special report requirements (i.e., state reporting forms, distribution of results to an attorney or consultant);
4. Known interferences or known high levels of a compound from a specified sample point should be identified so that special analytical procedures can be undertaken.
5. Sample filtering procedures which are to be used in the field should be noted on the forms.

After an order is placed or confirmed, ETC will contact the regional lab and place an order as appropriate. To confirm information concerning the sampling, copies of the Site Summary forms (Figure 3.3) will be sent to the regional lab and sampler. The sampling team is to use Facility Codes and Sample Point IDs as identified in the Part III and follow sampling instructions provided.

## FIGURE 3.3 EXAMPLE

Site Summary

Part III - Sampling and Analysis Requirements

DATE: 01/01/87  
Revision: #

SITE NAME: W.M.I.      FACILITY ID: 075      LOCATION: Oak Brook, IL

PROGRAM ELEMENT 1      DESCRIPTION: Shallow Monitoring Well -  
ANALYSIS GROUP      Area 4 and Area 5 - Quarterly

MATRIX: Water      #/TYPE SAMPLE POINTS: 4 wells

SAMPLE POINT IDS: W G1011   W G1022   W G1043   W G1054

SCHEDULE: Jan/Apr/Jul/Oct   TURNAROUND: 45 days   REPORT DUE: 30 days

PARAMETER	REPORT TO	PARAMETER	REPORT TO
GW PART III			
TOX (dup)	State	Groundwater Elevation	State
TOC (dup)	State	Temperature	State
pH (field)	WMI	Depth to Groundwater	WMI
Spec. Conductance (field)	WMI	Well Elevation	WMI
		Stickup	WMI
Methylene Chloride*	State		
Toluene*	State		
1,1,1,-Trichloroethane*	State		
Xylenes* (XVOA17, XVOA18)	State		
Chloride	State		
Chromium	State		
COD	State		
Cyanide	State		
Iron	State		
Lead	State		
Mercury	State		
Sulfate	State		
TDS	State		

SPECIAL INSTRUCTIONS: See Part IV - Special Instructions. \*Analysis by ETC;  
all other analysis by regional lab. State forms are to be completed. DM-OLC  
Report needed for State parameters only.

SAMPLING INFO: WMI's manual for groundwater sampling and State sampling  
procedures are to be followed; State policy has precedence. If there is  
insufficient sample, State parameters have priority.  
State parameters have priority.

## FIGURE 3.3 EXAMPLE

Site Summary

Part III - Sampling and Analysis Requirements

DATE: 01/01/87  
Revision: #

SITE NAME: W.M.I.      FACILITY ID: 075      LOCATION: Oak Brook, IL

PROGRAM ELEMENT: 2      DESCRIPTION: RCRA Program - Area 1 -  
ANALYSIS GROUP:      Semi-Annual

MATRIX: Water      #/TYPE SAMPLE POINTS: 8 wells and 1 field blank

SAMPLE POINT IDS: W G2021      W G2032      W G2  
                         W G2184      W G2084      W G2166  
                         W G2103      W G2201      X 02FB

SCHEDULE: January/July      TURNAROUND: 45 days      REPORT DUE: 30 days

PARAMETER	REPORT TO	PARAMETER	REPORT TO
GW PART II			
Chloride	RCRA	Groundwater Elevation	RCRA
Sulfate	RCRA	Temperature	RCRA
Phenols	RCRA	Depth to Groundwater	WMI
Manganese	RCRA	Well Elevation	WMI
Iron	RCRA	Stickup	WMI
Sodium	RCRA		
GW PART III QUAD			
TOC (quad)*	RCRA		
TOC (quad)*	RCRA		
pH (field/quad)	RCRA		
Spec. Cond. (field/quad)	RCRA		

SPECIAL INSTRUCTIONS: \*Analysis by ETC; remaining parameters analyzed by regional lab. Two DM-OLC reports are required: 1 with GWFII, Groundwater Elevation and Temperature and 1 with GWPIII/Quad parameters. State forms are required. These wells only need to be reported on RCRA Forms for RCRA parameters.

SAMPLING INFO: WMI's manual for groundwater monitoring and State sampling procedures are to be followed; State policy has precedence.

## FIGURE 3.3 EXAMPLE

Site Summary

Part III - Sampling and Analysis Requirements

DATE: 01/01/87  
Revision: #

SITE NAME: W.M.I.      FACILITY ID: 075      LOCATION: Oak Brook, IL

PROGRAM ELEMENT: 3      DESCRIPTION: Non-RCRA Program - Area 1  
ANALYSIS GROUP:      Quarterly

MATRIX: Water      #/TYPE SAMPLE POINTS: 10 wells and 1 field blank

SAMPLE POINT IDS: W G2011      W G2134      W G2197      W G2071  
                         W G2052      W G2155      W G2218      X 03FB  
                         W G2093      W G2176      W G2049

SCHEDULE: Jan/Apr/Jul/Oct      TURNAROUND: 45 days      REPORT DUE: 30 days

PARAMETER	REPORT TO	PARAMETER	REPORT TO
GW PART II			
Chloride	State	Methylene Chloride*	State
Sulfate	State	1,1,1.-Trichloroethane*	State
Phenols	State	Toluene*	State
Manganese	State	Xylenes* (XVOA17, XVOA18)	State
Iron	State		
Sodium	State	Depth to Water	WMI
GW PART III		Groundwater Elevation	State
TOC (dup)	State	Temperature	State
TOX (dup)	State	Well Elevation	WMI
pH (field)	State	Stick Up	WMI
Spec. Cond. (field)	State		
Alkalinity	State		
Boron	State		
TDS	State		

SPECIAL INSTRUCTIONS: See Part IV - State Form Instructions. \*Analysis by ETC; all other analysis by regional lab. State forms are to be completed.

SAMPLING INFO: WMI's manual for groundwater sampling and State sampling procedures are to be followed; State policy has precedence. 2 DM-OLC reports required.

## FIGURE 3.3 EXAMPLE

Site Summary  
Part III - Sampling and Analysis Requirements

DATE: 01/01/87  
Revision: #

SITE NAME: W.M.I.      FACILITY ID: 075      LOCATION: Oak Brook, IL

PROGRAM ELEMENT: 4      DESCRIPTION: RCRA Program - Area 2 -  
ANALYSIS GROUP:      Semi-Annual

MATRIX: Water      #/TYPE SAMPLE POINTS: 9 wells and 1 field blank

SAMPLE POINT IDS: W G201      W G164      W G1077  
                         W G122R      W G135R      X 04FB  
                         W G153R      W G146R

SCHEDULE: January/July      TURNAROUND: 60 days      REPORT DUE: 5 days

PARAMETER	REPORT TO	PARAMETER	REPORT TO
GW PART II		Ammonia	State
Chloride	RCRA	Boron	State
Sulfate	RCRA	COD	State
Phenols	RCRA	TDS	State
Manganese	RCRA		
Iron	State/RCRA		
Sodium	RCRA	Methylene Chloride*	State
		Toluene*	State
GW PART III/DUP		1,1,1,-Trichloroethane*	State
TOX (dup)	State/RCRA	Xylenes* (XVOA17, XVOA18)	State
TOC (dup)	State/RCRA		
pH (field)	RCRA	Depth to Groundwater	WMI
Spec. Cond. (field)	RCRA	Temperature	State/RCRA
		Groundwater Elevation	State/RCRA
		Stickup	WMI
		Well Elevation	WMI

SPECIAL INSTRUCTIONS: See Part IV - Special Instructions. \*Analysis by ETC; all other analysis by regional lab. State forms to be completed. Three DM-OLC Reports to be completed; one with State parameters, one with GWPII, Groundwater Elevation and Temperature, and one with GWPIII/Quad.

SAMPLING INFO: WMI's manual for groundwater sampling and State sampling procedures are to be followed; State policy has precedence.



## FIGURE 3.3 EXAMPLE

Site Summary

Part III - Sampling and Analysis Requirements

DATE: 01/01/87  
Revision: #

SITE NAME: W.M.I.      FACILITY ID: 075      LOCATION: Oak Brook, IL

PROGRAM ELEMENT: 5      DESCRIPTION: Non-RCRA Program - Area 2 -  
ANALYSIS GROUP:      Quarterly

MATRIX: Water      #/TYPE SAMPLE POINTS: 5 wells

SAMPLE POINT IDS: W G121      W G143      W G165  
                         W G132R      W G154

SCHEDULE: Jan/Apr/Jul/Oct      TURNAROUND: 60 days      REPORT DUE: 60 days

PARAMETER	REPORT TO	PARAMETER	REPORT TO
GW PART III/DUP			
TOX (dup)	State	Methylene Chloride*	State
TOC (dup)	State	1,1,1,-Trichloroethane*	State
pH (field)	WMI	Toluene*	State
Spec. Cond. (field)	WMI	Xylenes* (XVOA17, XVOA18)	State
Ammonia	State	Depth to Groundwater	WMI
Boron	State	Groundwater Elevation	State
Chromium	State	Temperature	State
COD	State	Stickup	WMI
Cyanide	State	Well Elevation	WMI
Iron	State		
Nickel	State		
TDS	State		
Zinc	State		

SPECIAL INSTRUCTIONS: See Part IV - State Form Instructions. \*Analysis by ETC; all other analysis by regional lab. State forms to be completed. DM-OLC with State parameters only.

SAMPLING INFO. WMI's manual for groundwater sampling and State sampling procedures are to be followed; State policy has precedence.

## FIGURE 3.3 EXAMPLE

Site Summary		DATE: 01/01/87	
Part III - Sampling and Analysis Requirements		Revision: #	
SITE NAME: W.M.I.	FACILITY ID: 075	LOCATION: Oak Brook, IL	
PROGRAM ELEMENT: 6	DESCRIPTION: Non-RCRA Program - Area 2 -		
ANALYSIS GROUP:	Semi-Annual		
MATRIX: Water	#/TYPE SAMPLE POINTS: 1 well		
SAMPLE POINT IDS:	W G101		
SCHEDULE: July/October	TURNAROUND: 60 days	REPORT DUE: 60 days	

PARAMETER	REPORT TO	PARAMETER	REPORT TO
GW PART III (DUP)		Cyanide	State
TOX (dup)	State	Nitrate	State
TOC (dup)	State	Nitrite	State
pH (field)	State	ROE	State
Spec. Cond. (field)	State	Zinc	State
GW PART II			
Chloride	State	Methylene chloride*	State
Sulfate	State	1,1,1-Trichloroethane*	State
Phenols	State	Toluene*	State
Manganese	State		
Iron	State	Depth to Groundwater	WMI
Sodium	State	Groundwater Elevation	State
		Stickup	WMI
Alkalinity	State	Temperature	State
Boron	State	Well Elevation	WMI
Chromium	State		
COD	State		

SPECIAL INSTRUCTIONS: See Part IV - State Form Instructions. Use forms marked "Routine Parameters." \*Analysis by ETC; remaining parameters analyzed by regional lab. State forms to be completed.

SAMPLING INFO: WMI's manual for groundwater sampling and State sampling procedures are to be followed; State policy has precedence.

FIGURE 3.3 EXAMPLE

## Site Summary

### Part III - Sampling and Analysis Requirements

DATE: 01/01/87  
Revision: #

```

SITE NAME: W.M.I. FACILITY ID: 075 LOCATION Oak Brook, IL
PROGRAM ELEMENT: 7 DESCRIPTION: RCRA Program
ANALYSIS GROUP: Semi-Annual

MATRIX: Water #/TYPE SAMPLE POINTS: 2 wells

SAMPLE POINT IDS: W G223
                  W G214

SCHEDULE: January/July TURNAROUND: 45 days REPORT DUE 30 days

PARAMETER REPORT TO PARAMETER REPORT TO
GW PART II
Chloride RCRA Groundwater Elevation RCRA
Sulfate RCRA Temperature WMI
Phenols RCRA Depth to Ground WMI
Manganese RCRA Well Elevation WMI
Iron RCRA Stickup WMI
Sodium RCRA

GW PART III QUAD
TOC (quad)* RCRA
TOX (quad)* RCRA
pH (field/quad) RCRA
Spec. Cond. (field/quad) RCRA

```

SPECIAL INSTRUCTIONS: \*Analysis by ETC; remaining parameters by regional lab.  
See Part IV - State form instruction. No State program,  
only RCRA program. Report RCRA parameters only on State forms.

SAMPLING INFO: WMI's manual for groundwater sampling and State sampling procedures are to be followed; State policy has precedence.

## FIGURE 3.3 EXAMPLE

Site Summary  
Part III - Sampling and Analysis Requirements

DATE: 01/01/87  
Revision: #

SITE NAME: W.M.I.      FACILITY ID: 075      LOCATION: Oak Brook, IL

PROGRAM ELEMENT: 8      DESCRIPTION: Leachate analyses - Monthly

ANALYSIS GROUP:

MATRIX: Water      #/TYPE SAMPLE POINTS: 3 leachates, 1 sanitary sewer effluent

SAMPLE POINT IDS:      Area A      Area C  
                         Area B      Discharge (EFFLUENT)

SCHEDULE: Jan/Feb/Mar/Jun/Jul/      TURNAROUND: 45 days      REPORT DUE: 10th of Month  
                 Aug/Sep/Oct/Nov/Dec

PARAMETER	REPORT TO	PARAMETER	REPORT TO
Priority Pollutants/Total*	WMI		
VOA	WMI		
Acetone*	WMI		
B/N/A*	WMI		
Pesticides/PCB*	WMI		
Metals (Total)	WMI		
Cyanide	WMI		
Phenols	WMI		

SPECIAL INSTRUCTIONS: Leachate analysis due to client 10th of month following.  
Report Metals as total. pH, specific conductance and temperature to be reported on field forms only, not in data base.

SAMPLING INFO: WMI's manual for groundwater sampling and State sampling procedures is to be followed; State policy has precedence. Samples to be taken 1st of month. Samples are not to be filtered. pH, Specific Conductance, and Temperature to be reported on field forms only.

## FIGURE 3.4 EXAMPLE

Site Summary  
Part IV - Administrative Information

Date: 01/01/87  
Revision: #

## I. GENERAL INFORMATION

SITE NAME: W.M.I.                      FACILITY ID: 075              LOCATION: Oak Brook, IL  
 SITE CONTACT 1: Frank Jarke      PHONE: 312/654-8800      LOCATION: Oak Brook, IL  
 SITE CONTACT 2:                      PHONE:                      LOCATION:  
 SAMPLING  
 TEAM:      W.M.I.                      PHONE: 312/654-8800      LOCATION: Oak Brook, IL  
 LOCAL LAB: Analytical Services      PHONE: 312/555-1212      LOCATION: Chicago, IL  
 CONTACT:  
 ETC CONTACT: Merna Hurd      PHONE: 201/225-5600      LOCATION: Edison, NJ

## II. BILLING INFORMATION

COMPANY: Waste Mangement, Inc.      PHONE: 312/654-8800      CONTACT: Frank Jarke  
 ADDRESS: 3003 Butterfield Road  
             Oak Brook, IL 60521  
 ATTN:      Accounts Payable  
 ACCOUNT #: 1811665                      P.O. NUMBER: Addendum 001

## III. SHUTTLE SHIPMENT

COMPANY: W.M.I.                      PHONE:                      CONTACT:  
 ADDRESS: 3003 Butterfield Road  
             Oak Brook, IL 60521

## IV. REPORT DISTRIBUTION

CONTACT: (A) Frank Jarke                      (B)                      (C)  
 COMPANY:      W.M.I.  
 ADDRESS:      3003 Butterfield Road  
                     Oak Brook, IL 60521

# COPIES:      1

## V. DATA MANAGEMENT INFORMATION

REPORTS REQUIRED:      DM-1L                      DM-OL (X)              DM-1H (X)              DM-OH  
                                  OTHERS:      DM-OCC Reports; All parameters;  
                                  State; RCRA Part II,III; State Form

SPECIAL INSTRUCTIONS: Standard Abbreviated technical and data management report described in WMI contract. State forms due 5/1, 8/1, 11/1, 2/1/88.

STATE FORMS INSTRUCTIONS: Two State forms must be submitted; one from ETC for its portion of the analyses, and one from the regional lab for its portion of the analyses. Regional lab to submit forms to ETC.

### 3.2 Presampling Procedures

Once the wells have been located and the order placed, a great deal of preplanning must be done to insure a flawless sampling event. These presampling procedures include the procurement and calibration of equipment, checking sample shuttles, filling out field forms, and purging the well. Each of these procedures is addressed in the following paragraphs. It is suggested that preparation for a sampling event begin at least two weeks before the event is to take place to insure time to accomplish all of the procedures and to leave time to correct any problems that surface.

#### 3.2.1 Organizing Equipment and Materials

All equipment necessary for a sampling event should be cleaned, checked, and, if necessary, calibrated prior to going into the field. As much preparation as possible should be done ahead of time since neither the facilities nor the material required for equipment cleaning and calibration may be available at the facility.

The following is a check list of equipment that may be required for a sampling event. In any case, it is a good place to start in preparing and assembling the required equipment for a sampling event.

Figure 3.5

EQUIPMENT LIST/CHECK-LIST

- |       |  |                             |                  |        |
|-------|--|-----------------------------|------------------|--------|
| _____ | 1) Bailers:  | PVC                         | Stainless        | Teflon |
|       | 3/4"   | _____                       | _____            | _____  |
|       | 1 1/2"   | _____                       | _____            | _____  |
|       | 3"   | _____                       | _____            | _____  |
| _____ | 2) Well Wizard equipment (two sets minimum):         | Hose                        |                  |        |
|       |  | Compressor                  |                  |        |
|       |  | Depth Indicator             |                  |        |
| _____ | 3) Pumps   |                             |                  |        |
| _____ | 4) Spare parts for wells:                            | _____ pump                  |                  |        |
|       |  | _____ hose                  |                  |        |
|       |  | _____ rope (nylon braided)  |                  |        |
|       |  | _____ bailers (see above)   |                  |        |
| _____ | 5) Well Wizard maintenance kit                       |                             |                  |        |
| _____ | 6) Field Meters:                                     | _____ pH                    | _____ calibrated |        |
|       |  | _____ specific conductivity | _____ calibrated |        |
|       |  | _____ temperature           | _____ calibrated |        |
| _____ | 6A) Back-up Field Meters:                            | _____ pH                    | _____ calibrated |        |
|       |  | _____ specific cond.        | _____ calibrated |        |
|       |  | _____ temperature           | _____ calibrated |        |
| _____ | 7) Site map with well locations                      |                             |                  |        |
| _____ | 8) Keys for wells and gates                          |                             |                  |        |
| _____ | 9) Well ID Chart                                     |                             |                  |        |
| _____ | 10) Personal Protective Equipment                    |                             |                  |        |
| _____ | 11) DI Water   |                             |                  |        |
| _____ | 12) Chain-of-Custody Forms and Field Parameter Forms |                             |                  |        |
| _____ | 13) Sample shuttles                                  |                             |                  |        |
| _____ | 14) Sample bottles                                   |                             |                  |        |
| _____ | 15) Extra bottles including pre-filtration bottles   |                             |                  |        |
| _____ | 16) Ice or ice packs                                 |                             |                  |        |

- 17) Preservative kit
  - 18) Pipe wrenches and tool chest
  - 19) Slope indicator or weighted tape
  - 20) Tape measure
  - 21) Fiber drum (about 25 gallon)
  - 22) Plastic bags (to provide clean work areas)
  - 23) Watch with second hand
  - 24) Bailer retriever
  - 25) Funnels--plastic and stainless steel
  - 26) Calibrated 5 gallon bucket
  - 27) Filtering equipment
  - 28) Hand soap--to preserve sample integrity
  - 29) Disposable Latex or PVC gloves (without powder)
  - 30) Beakers
  - 31) Paper towels
  - 32) Tape
  - 33) Flashlight
  - 34) Calculator
  - 35) Camera
  - 36) Site Summary Form - Part III
  - 37) Conversion Chart
  - 38) Markers and pens
  - 39) Vinyl notebook with clipboard
  - 40) Required filtration list
  - 41) Field meter log books for calibration
  - 42) pH buffers - 4, 7, 10
  - 43) Specific conductivity standards
  - 44) Extension cord (if required)
  - 45) Air source and regulator (if required)
  - 46) WMI Manual for Groundwater Sampling and the Site Specific  
Groundwater Monitoring Plan
  - 47) Clean vehicle (inside and out)
  - 48) Gasoline and oil - for well wizard compressor.
- Do not store near sampling equipment!



### 3.2.1.1 Bailers

Teflon bailers are preferable when monitoring for organics, and are appropriate for sampling all required RCRA parameters. Stainless steel bailers are the second choice. PVC bailers with non-glued joints may also be used. Non-dedicated bailers must be triple-rinsed with DI water between wells (under no circumstances may a substitute be used). Dedicated bailers require no rinsing.

### 3.2.1.2 Pumps

The selection of pumps should be geared to the nature of the parameters. There are several advantages and disadvantages to each type of pump. Use of suction lift pumps may result in degassing and loss of volatile components. Portable submersible pumps are not suitable when sampling for organics if lubricants are used in the pump. Gas stripping of volatile compounds may occur with air-lift samplers and are generally not suited for pH sensitive parameters such as metals. Well Wizards (air actuated, peristaltic pumps, constructed of PVC, stainless steel, or teflon), therefore, are the preferable equipment when pumps are needed.

When non-dedicated pumps are used, stringent cleaning procedures must be followed between sites. Before purging wells at the next site, sufficient amounts of deionized water must be flushed through the pump and tubing. Refer to Figures 3.6 and 3.6.1 for non-dedicated pumps cleaning documentation.

The cleaning procedures should be performed in a clean room/laboratory environment. The non-dedicated pump should be placed in a standpipe (PVC or stainless steel) filled with lab grade deionized water. (NOTE: A continual supply of DI water must be added to the standpipe.)

## NON-DEDICATED PUMPS LABORATORY CLEANING DOCUMENTATION

[illegible]

**Fig. 3.6.1**  
**EXAMPLE**

Revised 9/86

Initial specific conductance and amount of deionized water used should be accurately measured and recorded on Figure 3.6. Pump and tubing should continue to be flushed until the specific conductance of the discharged deionized water is within  $\pm 10$  ( $\mu\text{m}/\text{cm}$  @  $25^\circ\text{C}$ ) of the initial measurement. (See example--Figure 3.6.1.) Once this is achieved, the pumps and tubing should be properly stored and will be ready for use at the next site.

Decon procedures at the sample location are equally important. To ensure the integrity of the non-dedicated pump between wells, a minimum of 3-gallons of DI water should be used to thoroughly flush the pump and tubing before and after use in the well.

#### 3.2.1.3 Shuttles and Sample Bottles

The sampler will be responsible for checking all sample bottles and shuttles as soon as they are received, and for preparing ice packs prior to the sampling event. They are to notify ETC immediately as to any problems or questions. The shuttles may also be shipped to the local lab, subcontract sampler, or to the sampling site depending on the location requested when the order is placed. If the sample shuttles are shipped to the site, the subcontract sampler must coordinate with the site to ensure arrival of shuttles and to provide access to the site prior to sampling so equipment, shuttles, and supplies may be checked. If the sample shuttles are shipped to the local lab or subcontract sampler, coordination with the site is also necessary to confirm arrival of the shuttles and to arrange the checking of equipment and supplies.

A sampling event may use bottles from one or more labs in combinations such as:

- o All sample bottles and shuttles from ETC;
- o All sample bottles and shuttles from the designated local lab;

- o Combination of sample bottles and shuttles from ETC and the local lab;
- o On occasion, bottles may be supplied from a regulatory agency for split samples.

ETC provides sample shuttles, which are rugged carrying cases lined with insulating polyurethane and preformed slots for sample bottles. Ice packs are provided for thermal preservation of samples for up to 80 hours. Chain-of-custody seals and documentation, as well as preservatives, are also provided within the sample shuttle.

ETC will notify the sampler as to shuttle delivery arrangements and correct content of all containers. The team leader will receive, prior to the sampling event, documentation of the sampling program and codes on the Part III, Site Summary forms (see Figure 3.3).

Upon receipt of the shuttle, the black numbered seal must be examined. This should be intact. If it is not, contact ETC immediately for instructions. If the seal is unbroken, note the number on the seal for documentation on the Chain-of-Custody form.

After the seal is broken, the shuttle is opened and the sealed plastic bag is removed. The bag contains Chain-of-Custody forms, clear blank seals, return labels, and one black numbered seal. The black seal is used as the final seal for return shipment to the lab. The clear, unnumbered seals are to be used if the shuttle is left unattended.

The Chain-of-Custody forms should be carefully examined. The two pages (CC1 - Chain-of-Custody [Figures 3.8 and 3.8.1] and CC2 - Field Parameter form [Figures 3.9 and 3.9.1]) must be filled out and returned with the samples. Portions of the Chain-of-Custody form must be filled out when the shuttle is initially opened and checked (i.e., the seal number).

Prior to removing equipment from the shuttle, note the arrangement of the bottles and ice packs within in order to re-pack them in an identical arrangement. Shuttles are packed for economy of space and often, unless special attention is given, it is difficult to fit everything back into them.

An inventory of the bottles and their condition must be taken. The bottle list as well as analyses required and preservation requirements are noted on the Chain-of-Custody form in the "Sample Bottle" section. Each sample bottle is labelled with the lab number, the analysis to be performed, and the job numbers if assigned. All the bottles used for a particular sample must have the same job number, as several sets of sample bottles may be contained in the same shuttle.

Properly cleaned, new sample bottles are provided in each shuttle. The type of bottle will vary depending on the analysis required. For samples requiring preservatives, premeasured amounts of preservatives are supplied in small ampules and are attached to the proper bottle (except for TOX). The preservatives for this analysis are placed in the bottle prior to shipment. Each bottle is labeled to identify the preservatives which are required. Preservatives must not be introduced into bottles which do not require them. Verification that the appropriate preservatives have been included with the bottles and that the appropriate bottles are available is imperative. A list of sample bottles (type and size) and preservatives required for each analysis is included in Appendix I.

Each shuttle, which includes bottles for volatile organic analysis, includes a trip blank (40 ml vial filled with reagent free water). When volatile organic analysis has not been requested, a trip blank may be contained in the shuttle whether or not an order has been placed for analysis of the trip blank. Prior to shipment, the lab checks each vial to ensure that the blank has no air bubbles. On occasion, due to pressure and temperature changes, small bubbles

will appear in the blank. Condition of the blanks as well as any relevant information concerning condition of the shuttle should be noted on the Chain-of-Custody form.

For field blank analyses, the shuttle must include the bottles for preparing field blanks. Water, used by the sampling team in the field, will be used for these samples.

If any questions arise or if there are any problems with the shuttles and their contents, call ETC before proceeding.

Ice packs are contained within the shuttle to help maintain the temperature as required by EPA protocol. The sampling period must be planned so that there will be adequate time to allow freezing of the ice packs. Usually a 24-hour period is required to assure that the ice pack will be frozen solid. After the shuttle is checked, the ice packs are placed into the freezer and the CCI form is signed. The shuttle is closed and a clear seal is placed through one of the outside latches. The clear blank seals are to be used whenever the shuttle is left unattended. The black seal is to be used after sample collection for return of the shuttle to the lab.

#### 3.2.1.4 Equipment Storage

After all shuttles, containers, and equipment are checked, they must be stored prior to the sampling event in a designated, contaminant free area. The area must be locked. All shuttles must be sealed (clear plastic seal).

On occasion, not all bottles and containers will be used (i.e., the well was dry and no sample was obtained). These should be returned to the lab. Unused shuttles should be returned to the lab they came from via courier at the completion of the sampling event. The lab must be notified regarding the return of unused shuttles.

### 3.2.1.5 Calibration and Use of Meters

Field measurements along with proper documentation are integral parts of the monitoring program. Before the actual trip to the field, all equipment must be checked for possible malfunctions and cleaned.

Prior to use in the field, all meters must be calibrated by the sampling team to ensure proper working order and to render integrity to the measured values. Calibration procedures provided by the manufacturer are to be followed and attached to this manual. Where these are not available, Standard Methods should be followed.

NOTE: A COPY OF THE PROCEDURES USED SHOULD BE ADDED TO THIS MANUAL.

Calibration of the pH meter should be made with pH 7 and pH 10 buffers, and a pH 4 buffer as a check, or with pH 7 and pH 4 buffers, and a pH 10 buffer as a check, depending on the average expected pH values of the samples. The calibration for pH is temperature correlated. Please note the actual pH of your buffers at the temperature used for calibration. (A chart for this is usually provided on the buffer container.) You may need to calibrate the 7 buffer to 6.95 or 7.03 or some point in between, depending on the temperature of your buffers. The measured value for the check buffer must be within the recalibration limits listed at the bottom of the page. If not, the meter must be recalibrated.

Calibration of the specific conductivity meter should be made with a standard of approximately the same conductivity as those expected at the site, and should be measured at (or converted to) 25°C. At least one additional standard must also be checked. This standard should be of the same conductivity as the original standard, but should be cooled below room temperature (refrigerated). In checking the conductivity of this cooled standard, a verification will also be made of the automatic temperature compensation of the meter (or conversion calculation). The calibration check limit for this



second standard should be within  $\pm 1\%$  of the expected value. An additional (third) standard may also be used (if desired). In this case, a standard of higher or lower conductivity than the original standard should be used. The calibration check limit for this third standard should be within  $\pm 5\%$  of the expected value.

When rechecking the calibration of the field meters, the pH reading must be within  $\pm 0.1$  pH unit of the expected value (i.e., pH 4 buffer, calibrated to within pH 3.90-4.10). The specific conductivity value must be within  $\pm 5\%$  of the expected value (i.e., 1,413 umhos/cm standard, calibrated to within 1,342-1,484). If the recheck of the calibration of the instrument does not fall within these limits, the instrument must be recalibrated. The calibration of the field instruments must be checked every 4 hours and at the end of the day. If the calibration check is not within the limits listed above, the meter must be recalibrated.

Thermometers will be checked before each sampling event for accuracy against an NBS calibrated thermometer, and recorded in the field meter log book.

Each site is responsible for maintaining log books for all field meters. These log books contain the same information as those for permanent lab instruments (serial number, name and model of meter, year purchased, etc.). These books also contain QC results and calibration notes for each day the equipment is used.

NOTE: Log books may be obtained from the CWM Manager of Quality Control for use by CWM personnel. (Refer to Figures 3.7 and 3.7.1 for examples of a log book page.)

The specific conductance of the DI water being used in the field is measured and recorded each morning. The daily conductivity values are placed in the log book of the meter which is used (field or

lab). If the specific conductance of the DI water is greater than 50 umhos/cm at 25°C, the regional engineer should be contacted immediately. The DI water should not be used. DI water should then be obtained from an alternative source (local lab, ETC, etc.) until the problem can be corrected.

## FIELD METER LOG BOOK

**FIGURE 3.7**[illegible]

# FIELD METER LOG BOOK

FIGURE 3.7.1

EXAMPLE

DATE	METER #	TEMPERATURE		pH RESULTS						SPEC. CONDUCTIVITY				D.I. WATER
		NBS	METER	READ 7	CALIB. 7	READ 10	CALIB. 10	READ 4	CALIB. 4	STD..	AT 25°C	AT X°C	°C	SPEC. COND.
3/6/85	II	24.7°	25°	-	-	-	-	-	-	-	-	-	-	-
3/6/85	I	-	-	7.06	7.00	10.03	10.00	(check) 4.01	N/R	-	-	-	-	-
3/6/85	III	-	-	-	-	-	-	-	-	707	715	700	10°	<10
3/6/85	III	-	-	-	-	-	-	-	-	1413	1420	-	-	-
3/6/85	(backup) I (A)	24.3°	25°	7.04	7.00	10.08	10.00	(check) 4.03	N/R	707	700	723	10°	<10
3/6/85	(backup) I (A)	-	-	-	-	-	-	-	-	1413	1405	-	-	-

Revised 9/86

### 3.2.2 Field Records

Improper documentation or inadequate information regarding the circumstances of collection and/or subsequent disposition of the samples (i.e., chain-of-custody) may render any resulting data useless. Proper chain-of-custody documentation is crucial as part of the QA/QC program. Comprehensive, consistent, and accurate documentation of field tests, measurements, and field observations is also extremely important.

Two forms must be filled out by the sampler during a sampling event. A Chain-of-Custody form and a Field Parameter form are maintained for each sample. The original forms must be sent with the samples to the lab. Under no circumstances will samples be analyzed without these forms. The forms are included in the Technical Report submitted to the Regional Engineer from ETC when the analysis is complete. If sample bottles and shuttles are provided by ETC and the subcontract lab and each supplies Field Parameter forms, only one should be filled out for each sample point. The completed form should be returned with the shuttle for ETC. These forms must be completed with black (ball point) ink only. Pencils/felt-tip pens should not be used.

Copies of all forms are to be maintained by the Regional Engineer for easy reference. Analytical data must also be maintained in the site files.

#### 3.2.2.1 Chain-of-Custody Form (Figures 3.8 and 3.8.1)

In order to maintain the integrity of the samples, strict chain-of-custody procedures are necessary to ensure that tampering of the samples has not occurred.

From the time the sample bottles leave the laboratory until the issuing of the analytical laboratory results, the samples and/or sample containers must be in the custody of assigned WMI personnel

or an assigned consultant or contractor. In order to maintain chain-of-custody, the samples must be:

- o in sight of the assigned custodian;
- o locked in a tamper proof location; or
- o sealed with a tamper proof seal.

A written record of sample bottle possession and transference of samples must be maintained, as documented on the Chain-of-Custody form.

The Chain-of-Custody form is signed with the date and time for the following activities:

- o Whenever the shuttle is opened (the seal broken), the form must be signed. For the initial opening of the shuttle for inspection of contents, the seal number must also be noted;
- o The form must be signed each time the shuttle is transferred to the responsibility of another person;
- o The custody form must be signed and enclosed within the shuttle when the shuttle is sealed for transport to the lab. For ETC shuttles, the seal number must also be noted. Samples from the same sample point which are placed in more than one shuttle require a Chain-of-Custody form in each shuttle.

In addition, the sample point I.D., source code, date and time (start) for sampling must be recorded on the form. Use of pre-filtration bottles and any problems with shuttle contents must also be noted on the form. Upon receipt of the sample shuttle by the lab, the seal is broken, condition of the samples, temperature, date and time are recorded on the Chain-of-Custody form by the person receiving the sample shuttle.

The Chain-of-Custody form indicates by bottle and analysis group whether or not samples are to be preserved. If actual preservation and filtration procedures vary from the instructions provided in these spaces, the Chain-of-Custody instructions must be modified by a member of the sampling team and initialed in the appropriate locations provided on the Chain-of-Custody form or on the accompanying Field Parameter form. Failure to complete the Chain-of-Custody form in any event, will render the data useless.

## WMI GROUNDWATER MONITORING PROGRAM

## Chain-of-Custody Form

FIELD DESCRIPTION

Seal No.:	Actual number recorded from custody seal
Job #:	Assigned at time of shipment by ETC
Date Sealed:	Date shuttle sealed at ETC for shipment
By:	ETC personnel responsible for sending shuttle
Company:	Shipping information for shuttles
Facility/Site:	" " " "
Address:	" " " "
Attn:	" " " "
Phone:	" " " "
Facility:	Site code of facility being sampled
Sample Point:	Source code and sample point ID for monitoring point
Start Date:	Date monitoring point sampled
Start Time:	Time sampling begins (24 hour clock)
Elapsed Hours:	Time required to complete sampling in hours to the nearest tenth hour, if greater than one hour.
Shuttle Contents:	
Bottle No.:	How many bottles of this type are in shuttle
Type:	Type of bottle, usually by test procedure
Size:	Volume of bottle
Preservative:	Preservative for this bottle
Analysis:	Analysis to be performed
Filtered:	Filtered, yes or no

Sampler Observations: Note if the bottle was intact, preservatives missing, or any other problems with the bottles. Any additional problems with the shuttles should be noted on this form as well (e.g., shuttle odor, broken shuttle clasp, etc.). Also, note if filtration was done in-line, or with pressure filtration in the field or in the lab.

Lab Observations: Problem with receipt of bottle (e.g., empty, broken, missing, leaking, etc.) or shuttle.

Chain-of-Custody Chronicle:

1. To be filled out by person opening and checking shuttle contents.
- 2, and 3 To be filled out by persons other than opener who had temporary custody of sample shuttle.
- 4 To be filled out by person releasing shuttle to shipper or who finally seals it. Names listed for numbers 3 and 4 must be the same.

NOTE: Please include the name of your employer next to your signature on the Chain-of-Custody Chronicle.

If additional space is needed, an additional Chain-of-Custody form or piece of paper may be attached to the original form. Do not write on the back of the form.



CHAIN OF CUSTODY FORM (CC1)

FIGURE 3.8

Company: \_\_\_\_\_ Attn.: \_\_\_\_\_

City/Site: \_\_\_\_\_ Phone: \_\_\_\_\_

Address: \_\_\_\_\_

### SAMPLE IDENTIFICATION

**Facility:**

1	2	3	4	5	6	7	8	9	0	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

Facility Site Code

(Optional Sample Point Descriptions)

**Sample Point:**

Source Code <small>(from below)</small>	Your Sample Point ID <small>(left justify)</small>	Start Date <small>(YY/MM/DD)</small>	Start Time <small>(2400 hr clock)</small>	Elapsed Hours <small>(composite)</small>
<div style="border-bottom: 1px solid black; width: 100%; height: 1em;"></div>	<div style="border-bottom: 1px solid black; width: 100%; height: 1em;"></div>	<div style="border-bottom: 1px solid black; width: 100%; height: 1em;"></div>	<div style="border-bottom: 1px solid black; width: 100%; height: 1em;"></div>	<div style="border-bottom: 1px solid black; width: 100%; height: 1em;"></div>

### Source Codes:

Well (W)	Outfall (O)	Bottom Sediment (B)	Surface Impoundment (I)	Leachate Collection Sys (C)	Other (U)
Soil (S)	River/Stream (R)	Generation Point (G)	Treatment Facility (T)	Lake/Ocean (L)	Specify (S)

## SHUTTLE CONTENTS

[illegible]

## CHAIN OF CUSTODY CHRONICLE

1.	Shuttle Opened By: (print) _____	Date: _____	Time: _____
	Signature: _____	Seal #: _____	Intact: _____

2.	I have received these materials in good condition from the above person.		
	Name: _____	Signature: _____	
	Date: _____	Time: _____	Remarks: _____

3. I have received these materials in good condition from the above person.  
 Name: \_\_\_\_\_ Signature: \_\_\_\_\_  
 Date: \_\_\_\_\_ Time: \_\_\_\_\_ Remarks: \_\_\_\_\_

4. Shuttle Sealed By: (print) \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_  
Signature: \_\_\_\_\_ Seal #: \_\_\_\_\_ Intact: \_\_\_\_\_

LAB USE ONLY Opened By: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

SHUTTLE # \_\_\_\_\_ TEMP. °C \_\_\_\_\_ SEAL # \_\_\_\_\_ COND. \_\_\_\_\_



### 3.2.2.2 Field Parameter Form (Figures 3.9 and 3.9.1)

The Field Parameter form contains information regarding site and well conditions, sampling and purging procedures used, and field measurements. The Field Parameter form must be filled out by the sample collector for each sample point and enclosed in the sample shuttle. If sample bottles are split between ETC and the local lab, the Field Parameter form (CC2) must be enclosed in the shuttle transported to ETC only. A completed (CC2) form does not have to be completed for the subcontract lab. Field Parameter forms must be filled out for each sample point, including dry wells. Information to be documented is as follows:

#### Sample Point

The source code and sample point ID are contained on the Chain-of-Custody form for the sample. This information will be provided prior to sampling by ETC on the Site Summary form (Figure 3.3). All sample point ID's must be identical to the codes in the EMMS. For new sample point ID's, the Corporate Environmental Staff should be contacted concerning appropriate coding.

#### Purging Information

This section should be completed if the sample points are wells. All wells must be purged prior to sampling. The date and time the well was purged, the elapsed time for purging, the volume of water in the casing (gallons), and the volume purged (number of gallons) must be documented.

The Chain-of-Custody and Field Parameter forms must document the purging data and indicate if the well was dry and if a sample was not collected.

### Sampling Information

The types and materials of construction of equipment used for collection is to be documented. If Well Wizards or pumps are used, the tubing material must be documented. If a code number does not correspond to the actual material, then a written description must be provided.

### Sample Compositing

For samples composited in the field, the procedures and proportions of samples used are to be described. For example, one quart obtained hourly by grab sampling over 8 hours.

### Field Measurements

The Site Specific Monitoring Program indicates which measurements are to be taken for each sampling event. For groundwater sampling events, the groundwater elevation (depth to groundwater adjusted to MSL), temperature, pH, and specific conductance at 25°C are to be determined. Additional parameters, e.g., color, odor, and turbidity, may also be required if noted on the Part III Site Summary form. Space is provided for these additional parameters. The units and values of these measurements are to be noted.

### Field Comments

The section on field comments should include field observations such as:

- o Condition of the well and dedicated equipment
- o Weather condition--wind direction and speed, upwind activities, rain, snow, temperature, cloud cover, barometric pressure (where required per regulatory requirements), etc.

- o Sample appearance - odor, color, turbidity  
Odor: Rotten eggs, earthy, strong, moderate, slight, metallic  
Color: True "color" is the color after the turbidity has been removed. The color observed after sampling is an "apparent color", influenced by sediment in the sample. True color may be caused by metallic ions, humus, peat, industrial chemicals. Hold the sample up to the light and describe the color as well as possible. Observations may include: no color (clear), brown, gray, yellow, etc.  
Turbidity: None--sample is clear.  
Trace - Sediment only slightly clouds or colors the sample. Sediment does not accumulate at bottom of bottle.  
Moderate - Definite cloudiness/color. Sediment accumulates at bottom of sample bottle.  
High - Muddy appearance.
- o Reference point for well measurements
- o Well ID where field blank is prepared.
- o All calculations for purge volumes and temperature conversions, as well as if well was purged dry, or an explanation when less than 3 casing volumes are removed.
- o Duplicate field measurement results.
- o Other conditions, such as sample splits with regulatory agencies, potential safety or health hazards (i.e., fire ants, dry well, etc.).

NOTE: When samples are split with regulatory agencies, note the condition of the bottles, preservatives used, etc., by the agency on the summary sheet.

#### Sampling Certification

On the bottom of the Field Parameter form, the sampler/team leader must sign the form certifying that the sampling procedures were in accordance with applicable Federal, State, and Corporate Policy as outlined in the WMI Manual for Groundwater Sampling and the Site-Specific Monitoring Plans. The person signing the sampling certification must be present during the entire sampling event.

**ETC** ENVIRONMENTAL  
TESTING and CERTIFICATION

ETC JOB # \_\_\_\_\_

**FIELD PARAMETER FORM (CC2)**Sample Point ☐ \_\_\_\_\_

Source Code

Sample Point ID

**FIELD PROCEDURES**☐PURGE DATE  
(YY MM DD)☐START PURGE  
(2400 Hrs Clock)☐

ELAPSED HRS

☐WATER VOL IN CASING  
(Gallons)☐VOLUME PURGED  
(Gallons)**SAMPLING METHOD:** \_\_\_\_\_Sampler Type ☐A-Submersible Pump  
B-ISCO  
C-Bladder PumpD-Dipper/Bottle  
E-Bailer  
F-Scoop/Shovel

X-Other \_\_\_\_\_

(SPECIFY OTHER)

Sampler Material ☐A-Teflon  
B-MetaC-PVC  
D-Plastic

X-Other \_\_\_\_\_

(SPECIFY OTHER)

Tubing Material ☐A-Teflon  
B-TygonC-Polyethylene  
D-Silicon

X-Other \_\_\_\_\_

(SPECIFY OTHER)

Sample Compositing ☐ Y/N

Procedure/Proportions

**FIELD MEASUREMENTS**Well Elevation (ft/msl) ☐Depth to Ground water (ft) ☐Groundwater Elevation (ft/msl) ☐Well Depth (ft) ☐Sample Depth (non-well) (ft) ☐1st ☐

(STD)

pH

15: ☐

SPEC COND

um/cm  
at 25 °C

Other parameter

value

UNIT

2nd ☐

(STD)

pH

20: ☐

SPEC COND

um/cm  
at 25 °C

Other parameter

value

UNIT

3rd ☐

(STD)

pH

3rd ☐

SPEC COND

um/cm  
at 25 °C

Other parameter

value

UNIT

4th ☐

(STD)

pH

4th ☐

SPEC COND

um/cm  
at 25 °C

Other parameter

value

UNIT

☐

Sample Temp

(°C)

☐

Turbidity

NTU

**FIELD COMMENTS**

Sample Appearance: \_\_\_\_\_

Weather Conditions: \_\_\_\_\_

Other: \_\_\_\_\_

**FILTERING: Use Chain of Custody (CC1) to indicate which bottles were filtered**

Sampler: \_\_\_\_\_

(Print)

Employer: \_\_\_\_\_

I certify that sampling procedures were in accordance with applicable EPA state and corporate protocols.

Date

Signature

ETC ENVIRONMENTAL  
TESTING and CERTIFICATIONETC JOB # 7001

## FIELD PARAMETER FORM (CC2)

Sample Point W EIS 12  
Source Code Sample Point ID

## FIELD PROCEDURES

860318  
PURGE DATE  
(YY MM DD)0852  
START PURGE  
(2400 Hr Clock)11.5  
ELAPSED HRS115  
WATER VOL IN CASING  
(Gallons)47  
VOLUME PURGED  
(Gallons)

## SAMPLING METHOD:

C+X 3/18/86  
 Sampler Type ☒ A-Submersible Pump D-Dipper/Bottle  
☒ B-ISCO E-Bailer  
☐ C-Bladder Pump F-Scoop/Shovel X-Other Well Wizard  
 (SPECIFY OTHER)  
 Sampler Material ☐ A-Teflon C-PVC  
☐ B-Metal D-Plastic X-Other \_\_\_\_\_  
 (SPECIFY OTHER)  
 Tubing Material ☐ C A-Teflon C-Polyethylene  
☐ B-Tygon D-Silicon X-Other \_\_\_\_\_  
 (SPECIFY OTHER)  
 Sample Compositing ☒ Yes ☐ No

Procedure/Proportions

## FIELD MEASUREMENTS

Well Elevation (ft/msl) 117.63\* Well Depth (ft) 43.1\*  
 Depth to Ground water (ft) 20.14 Sample Depth (non-well) (ft) \_\_\_\_\_  
 Groundwater Elevation (ft msl) -2.51

1st	2nd	3rd	4th
<u>7.76</u> (STD) <u>3640</u> <u>3/18/86</u> pH spec. cond. uniform at 25°C	<u>7.77</u> (STD) <u>3660</u> <u>3/18/86</u> pH spec. cond. uniform at 25°C	<u>7.82</u> (STD) <u>3660</u> <u>3/18/86</u> pH spec. cond. uniform at 25°C	<u>7.78</u> (STD) <u>3650</u> <u>3/18/86</u> pH spec. cond. uniform at 25°C
<u>12.6</u> (°C) _____ NTU	Turbidity		

## FIELD COMMENTS

Sample Appearance: Clear, light yellow, strong odor  
 Weather Conditions: Sunny, 73°, winds SE ~ 10 mph  
 Other: \* From well 10 Chart. Hornets nest in well, cows grazing just outside fence, water in annulus space.  
Purge volume = 43' - 20' = 23 x 0.652 (4' casing) = 15 gals x 3 = 45 gals to be purged. Sample discharge tube replaced. FB (F7632) prepared at this well. DTW from top of metal casing  
Duplicates pH 7.75, 7.78, 7.74, 7.82  
temp. 12.8°C SC 3650, 3660, 3640, 3650

FILTERING: Use Chain of Custody (CC1) to indicate which bottles were filtered

Sampler: Lisa Grassl (Print) Employer: CWMI - N. Region

I certify that sampling procedures were in accordance with applicable EPA state and corporate protocols.

3/18/86 Lisa Grassl  
 (Date) (Signature)

### 3.2.3 Well Observations and Measurements

It is very important during each sampling event that various observations concerning the condition of the well be made. Also required are specific measurements during a sampling event such as purge volume, water level, and depth of well. These observations and measurements are all documented on the Field Parameter form.

#### 3.2.3.1 Observe Maintenance Conditions at Well

The conditions of the well and its surrounding area are observed and recorded on the Field Parameter form upon arrival at the well location. The following information should be noted:

- o The presence and condition of the well's identification sign
- o Was the well recently painted?
- o Is the well locked and does the key work?
- o Well integrity:
  - o physical surroundings (high weeds, standing water, cleanliness, activities nearby)?
  - o condition of Well Wizard or dedicated bailer?
  - o condition of protective casing?
  - o obstructions or kinks in well casing?
  - o condition of cement footing--cracked, raised?
  - o water in annular space?
  - o grease around top of well on threaded caps?
  - o does cap fit securely so contaminants can't penetrate?
- o Weather conditions: include wind direction for volatiles and note if sampling was performed downwind.
- o Evidence of contamination: animal or insect parts in well, etc.
- o Well guard posts' condition



### 3.2.3.2 Measurements to Determine Purge Volume

The elevation of the groundwater at each monitoring well is determined for each sampling event. Measurement of the static water level is taken prior to well purging and sample withdrawal. The elevation of the groundwater is then determined by the following equation:

$$\begin{aligned} \text{Groundwater Elevation (msl)} = \\ \text{Elevation at top of casing (ft msl)*} - \text{Depth to water} \\ \text{(ft)} \end{aligned}$$

\*From Well ID Chart

Note: All well measurements must be made from the point at which the elevation was measured (i.e., top of well casing). This point must be noted in the comments section of the Field Parameter form.

#### Static Water Level Measurements

If wells have not been equipped with Well Wizards which contain static head sensors to measure depth (refer to Appendix II), a water level or slope indicator (or similar device) or weighted tape, is used to determine the static level of water in the well, as well as the total depth of the well. Water level indicators with lead weights should not be used.

A slope indicator works on a conductivity principle--an alarm sounds and a red light is illuminated when the probe comes in contact with the water. The cable is permanently marked in increments of 1 foot (0-150 feet). To measure the static water level with a slope indicator, the procedure below should be followed:

- 1) Rinse the slope indicator cable off with DI water. Shake off all excess water.

- 2) Switch the sensitivity dial on to 4-5. Depress the red button. The red light should be illuminated and a buzzing sound should be heard. This will ensure that the meter is working.
- 3) Slowly unreel the cable in the well until the buzzing sound can be heard and the illuminated red light on the meter is observed.
- 4) Slowly raise and lower the cable to a point when the buzzer and light (together) just begin. This indicates the static water level.
- 5) Using the thumb and an index finger, mark this position on the cable--using as a reference point, the point at which the elevation has been measured.
- 6) Measure the distance with a ruler between the closest one foot increment and the point marked to the nearest inch. Record on the Field Parameter form.
- 7) Rinse the slope indicator off with DI water after reeling the cable back onto the spool.
- 8) Shake off all excess water.
- 9) All measurements taken in feet should be converted to hundredths of a foot. Example: measure 10'8" = 10.67'. (See Conversion Chart in Appendix I).

In order to determine the depth to water using a weighted tape, the following procedures should be followed:

- 1) Check to see that the weight (or popper) is securely fastened to the tape.

Wire, teflon coated if possible, is the preferred method for attaching the weight to the tape.

- 2) Thoroughly rinse the tape and weight with DI water.
- 3) Shake off excess water.
- 4) Slowly lower the weighted tape into the well, until the weight can be heard hitting the water.
- 5) Raise and lower the tape to determine the precise location where the weight comes in contact with the water.

If the well casing is wet, the tape may cling to the sides of the well. If this should occur, shaking the tape while lowering and raising should provide an accurate measurement.

- 6) While holding the tape to the location where the elevation has been recorded, note the measured value.
- 7) Record the measurement on the Field Parameter form.

If the end (bottom) of the weight has not been attached to the tape as the zero inch mark, the original measurement will need to be recorded on the Field Parameter form in the comments section. The additional distance, as measured from the end of the tape to the end of the weight, should be added to the original measurement. This final value should then be placed on the Field Parameter form under field measurements.

- 8) Reel the tape and weight out of the well while wiping off any dirt or sediment.
- 9) Thoroughly rinse the tape and weight with DI water.
- 10) Shake off excess water.

### Depth of Well Measurements

This measurement is required every two years. Wells with dedicated pumps installed are exempt from this measurement. The depth of well, when not measured, should be obtained from the Well ID Chart and noted on the Field Parameter form and also noted in the comments section, "from Well ID Chart".

Use of the slope indicator or weighted tape for measuring the depth of the well is not as accurate as the water level measurement, as the bottom is determined entirely by "feel". This measurement should be reported to the nearest foot and is used to calculate the volume of water in the casing for purging operations.

- 1) After a recording of the static water level, unreel the cable or tape, until it hits the bottom of the well.
- 2) Slowly pull up the slack until slight tension is felt on the cable.
- 3) Slowly raise up and down until a feel for the bottom is obtained.
- 4) Using as a reference point the point at which the elevation has been measured, mark the cable using a finger, and measure as for the water level.
- 5) Reel the cable back on the spool, rinse with DI water, and shake off all excess water.
- 6) Record measurement on Field Parameter form.

### 3.2.3.3 Additional Field Measurements

At this time, stick-up (required annually) and casing size are measured and recorded on the Field Parameter form (Figure 3.9). Additional sampling and purging information, as listed on this form, should also be recorded (i.e., sampler type, material, etc.).

#### 3.2.4 Purging the Well

Monitoring wells should be pumped or bailed prior to sample withdrawal to safeguard against collecting non-representative stagnant water in a sample. As a general rule, pump or bail a minimum volume of 3 times the volume of water standing in the well (for moderate to high yield formations) and at least one casing volume for low yield formations (those with slow recharge). Well purging should be sufficient to ensure that water which is representative of the groundwater has entered the well.

If a monitoring well is a very low yield well, bail the volume of water standing in the well and allow the well to recharge for 24 hours. If there is insufficient water for sampling any parameter, then the well is considered dry for the sampling event. If the volume of water available is insufficient for filling all of the sample containers, portions of the sample is to be collected (unless otherwise specified by the regulatory agency or the Regional Engineer). In all of these situations, notify the Regional Engineer immediately.

If a well which normally can be purged is dry, contact the Regional Engineer immediately.

Note: Clay till wells may be allowed to recharge for three (3) days, or as otherwise specified by the Regional Engineer.

When purging a well with a double pump system (upper & lower), six screen volumes must be removed from the well, unless otherwise specified by the Regional Engineer. In all double pump wells, the upper (purge) pump must be left on while the lower pump is used for sampling.

3.2.4.1 Calculating Purge Volume

To determine the volume of water to be purged, calculate:

$$\begin{aligned} \# \text{ of feet in water column} = \\ \text{total well depth (ft)}^* - \text{depth to water (ft)} \end{aligned}$$

Then refer to the purge volume charts on the next two pages.

\* From the Well ID chart, or as measured.

NOTE: Volumes in these charts must be multiplied by the # of casing volumes of water to be purged (i.e., for moderate to high yield formations, multiply the value by at least 3). Purge volumes may also be determined by calculation. (The formula for this calculation is given in Appendix I.)

Example:

## FIELD MEASUREMENTS

Well Elevation (ft/msl)	48.56*	Well Depth (ft)	27.*
Depth to Groundwater (ft)	3.63		
Groundwater Elevation (ft/msl)	44.93	*From Well ID Chart	

## FIELD COMMENTS

2" well casing

27 - 3.63 = 23.37 feet of water in column

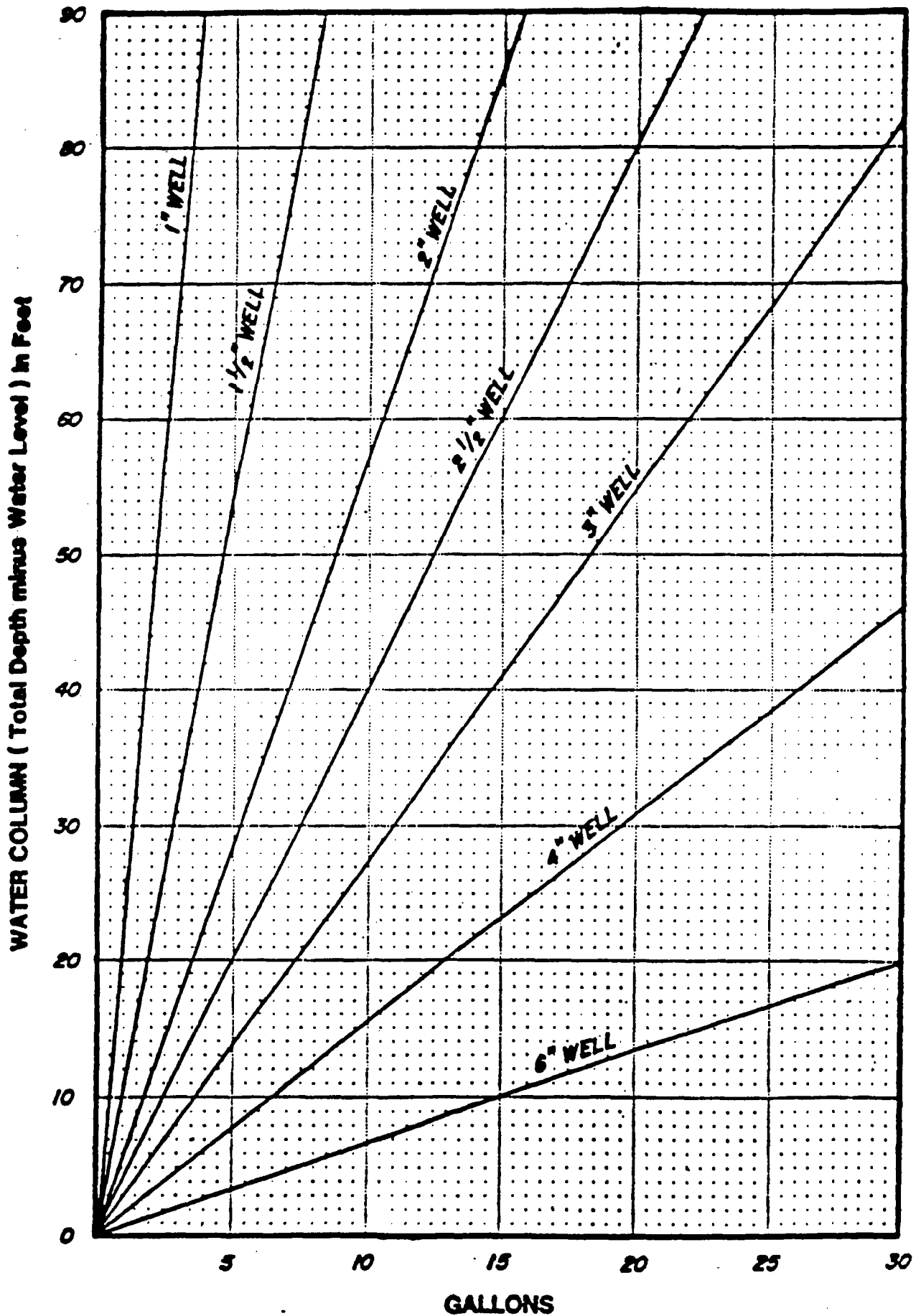
From purge volume charts:

4 gallons of water to be purged for one casing.

4 gallons x 3 casings = 12 gallons of water to be purged.

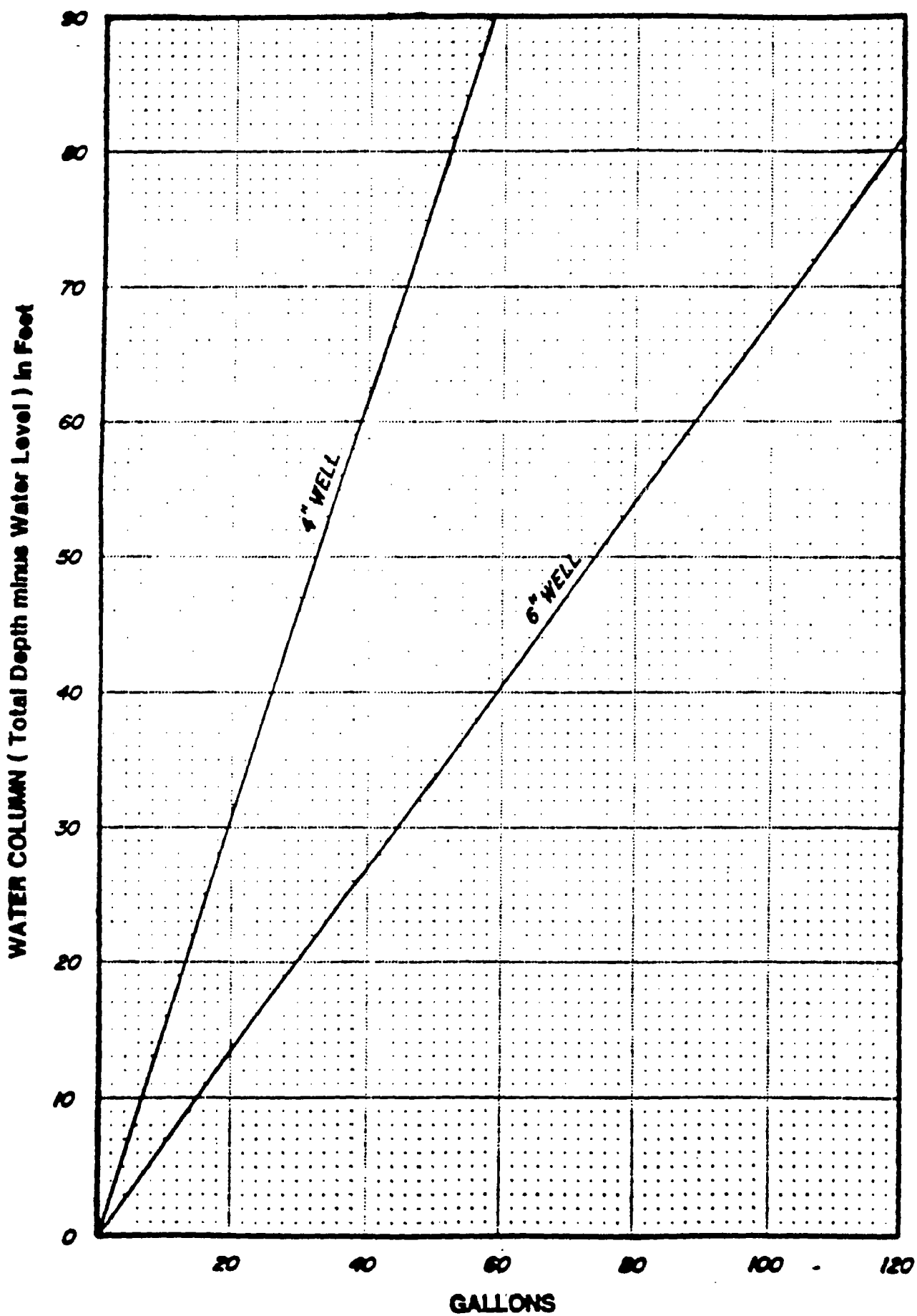
Note: Low yielding well - purged 1.5 casing volumes. Well purged dry! Heavy sediment/strong odor.

# PURGE VOLUME CHART 1



# PURGE VOLUME CHART 2

Revised 9/86





Example: 4" well casing

High yield formation (purge 3 casing volumes)

Total well depth = 46'

Depth to water = 14.33'

$46' - 14.33' = \underline{31.67'}$  of water in column

From purge volume charts:

21 gallons of water to be purged for one casing.

21 gallons x 3 casings = 63 gallons of water to be purged

The recovery time may be noted on the Field Parameter form in the "other" section. This should initially be determined during development of a newly installed well.

#### 3.2.4.2 Purging the Well

After the necessary field measurements are made and the volume of water to be purged is determined, the purging process is begun.

The single most important objective while purging a well is minimizing contamination. Equipment should never touch the ground or any other possible contamination sources. For example, a fiber drum lined with a new plastic bag may be used to collect the rope in when using a bailer. Purged water should be discarded away from the well footing. This will prevent the possibility of contamination due to the formation of mud.

To measure the volume of water being removed from the well, a calibrated 5-gallon bucket or a known volume container may be used to collect the water.

#### 3.2.4.2.1 Procedure Using Bailers

When using a bailer for purging, the largest available bailer that will fit into the well should be used in order to minimize purge time.

Nylon rope, preferably braided, is to be used. It is imperative that new rope be utilized. In addition, the rope should be of adequate length and strength--thicker rope is easier to grip. The rope should be fastened to the well cap. Where this is not possible, the rope should be secured to a large spool to prevent loss of the rope and bailer in the well.

If a non-dedicated bailer is used, the bailer must be triple rinsed inside and out with high quality, organic free DI water before purging. Additionally, the people handling the bailer should wash their hands before purging the well. Disposable PVC or latex powderless gloves must be worn. New gloves should be used at each well or more frequently (e.g., dirty, torn, etc.). The rope should be tied onto the bailer securely and checked with each bail during the purging process.

The purging of the well is accomplished by a repetitive lowering, raising, and dumping of the bailer.

- 1) Slowly lower the bailer into the well until the bailer contacts the water.
- 2) Allow the bailer to fill with water. The bailer will "gulp" when it is full and increased tension will be felt on the rope.
- 3) Pull the bailer out of the well while coiling the rope and dropping it in the plastic bag lined fiber drum.
- 4) Pour out the water from the bailer, into a calibrated bucket, and observe water characteristics.
- 5) Repeat the process until the appropriate volume of water has been purged from the well.

Suggested precautions while purging a well:

- 1) Lower the bailer slowly into the well;
  - so as to prevent contamination from rust or other sediment which may accumulate around the top of the well casing.
  - to minimize the upwelling of bottom sediment.
  - to minimize the possibility of the bailer becoming lodged in the well due to a kink in the well casing.
  - to minimize the chance of the rope becoming untied from the bailer.
- 2) Never allow the bailer to come in contact with any surface other than your hands and the inside of the well.
- 3) Always be conscious of possible contamination sources (i.e., grease on well cap, etc.).

#### 3.2.4.2.2 Procedure Using Non-Dedicated Pumps

Non-dedicated pumps are most often used for purging when large volumes of water must be removed from the well prior to sampling. The best, and most commonly used pumps are submersible, centrifugal pumps. These pumps may only be used in wells of four (4) inches diameter or larger due to their size.

All of the equipment must be thoroughly rinsed with DI water and air dried before using. The samplers should wash their hands before purging the well. Disposable PVC or latex powderless gloves must be worn. New gloves should be used at each well or more frequently (e.g., dirty, torn, etc.).

Purging of the well basically involves the correct placement of the pump and turning it on.

- 1) Slowly lower the equipment (pump, hose, rope) into the well. All of the equipment must be lowered simultaneously to prevent possible jamming of the equipment in the well.

- 2) Place the pump well below the static water level head, (above the well screen) as damage to the pump may occur if the pump is run dry for even a few seconds.
- 3) Turn on the pump. Assuming a high recharge, remove 2-1/2 well volumes at the initial pump position.
- 4) Continue purging while raising the pump, until the static water level is reached.
- 5) Turn pump off.
- 6) Lower pump to just below the static water level and complete purge.
- 7) Turn pump off.
- 8) Remove equipment from the well when purging is complete. All equipment must be removed simultaneously to prevent possible jamming of the equipment in the well.
- 9) Rinse and dry all equipment before reusing, per procedure for cleaning non-dedicated pumps on page 39.

#### 3.2.4.2.3 Dedicated Pump Procedure

Dedicated pumps involve the connection of the dedicated pump to its power source and turning it on. Electrical power sources (where possible) are preferred in order to minimize possible contamination sources.

#### 3.2.4.2.4 Well Wizard Procedure

See Appendix II.

NOTE: Well Wizard sample discharge tubes should be replaced when directed by the Regional Engineer.

### 3.3 Sampling the Well

You are now ready to achieve the main objective of the sampling procedures--taking the samples. Groundwater samples should be collected in the shortest possible time while maintaining sampling integrity.

#### 3.3.1 Field Measurements

At a minimum, three field measurements must be conducted on each sample point after purging: pH, specific conductivity, and temperature. A separate bottle or beaker should be used for these measurements. These bottles may be reused, if thoroughly rinsed with DI water after use, and rinsed thoroughly with sample water before use. All results must be recorded on the Field Parameter form, noting units and three (3) significant figures. (All pH meters must be able to provide a reading to the hundredths place [i.e., 7.14]).

When field measurements appear to be in error, all data must be discarded, new samples taken, and all new measurements made. Errors should be crossed out with one line and initialed.

Duplicate field measurements must be taken for 1 out of every 10 samples, or at least once per day (for quads, four duplicate measurements are made). The duplicate field measurements are recorded on the Field Parameter form (CC2) in the comments section.

If the values obtained are not within the normal ranges, as stated on the Well ID Charts in the Site's Groundwater Monitoring Plan, notify the Regional Engineer immediately. Do not discard this sample, as regulatory requirements specify that analysis be performed on it. Additional samples may be requested by the Regional Engineer to ascertain the cause of abnormal readings.

For RCRA sampling, pH and conductivity measurements must be done in quadruplicate. Four measurements are to be made from one sample container. Between measurements, the instrument should be turned off, rinsed, and dried.

### 3.3.2. When Not to Sample

During a sampling event, all wells must be sampled, except in the following cases:

- \* Well has been destroyed or otherwise rendered useless (i.e., casing broken off or severely bent so as to preclude sampling).
- \* Well is dry (i.e., no water can be pumped within 24 hours of purging, or bailed without dropping the bailer all the way to the silt at the bottom of the well to obtain a partial bailer full of water, unless regulatory requirements dictate awaiting a longer recharge time or as specified by the Regional Engineer).
- \* Well is new and has not been properly developed (pH and specific conductivity must be stabilized).
- \* The Regional Engineer states that the sampling should not be done.

### 3.3.3 Sampling

The method to be used for sampling is usually the same as that used for purging, unless otherwise specified by regulatory agencies or the Regional Engineer.

Procedures for sampling include the same steps as those for purging, with the exception being that in sampling, the water removed from the well is placed in sample bottles rather than being discarded.

### 3.3.4 Filling Sample Bottles

Sample bottles should be filled directly from the bailer or pump with a minimal amount of air contact. TOX and volatile organics bottles should be headspace-free. All samples must be filtered per Corporate policy (Sec. 3.3.7) unless specifically stated otherwise. Where in-line filtration is not available, pre-filtration bottles should be used to collect the samples. This is to assure that no sediment will be introduced into the filtered sample which could cause possible analytical errors. Pre-filtration bottles must be obtained from ETC/Local Lab with the sample shuttles. Plastic containers should be used for inorganic parameters only. Any organic parameters to be filtered must be placed in glass pre-filtration jars. All bottles or containers must be kept in a clean and locked storage area.

When filling the sample bottles, these important procedures and precautions must be followed:

- 1) Bottle caps should be removed carefully so that the inside of the cap is not touched. Caps should never be put on the ground. Caps for VOA vials contain a teflon lined septum. The teflon side of the septum must be facing the sample to prevent contamination of the sample through the septum.

NOTE: UNDER NO CIRCUMSTANCES SHOULD BOTTLES (SAMPLE OR PRE-FILTRATION) OR CAPS NOT SUPPLIED BY ETC OR THE LOCAL LAB BE USED FOR ANY SAMPLING EVENT!

- 2) The sample bottles should be filled with a minimal amount of air contact, and without allowing the sampling equipment or personnel to contact the inside of the bottles.

Tubing or hoses from Well Wizards or pumps must not be placed into the sample bottles.

- 3) Samples which are to be filtered and preserved, should be placed in pre-filtration bottles and filled completely full to allow for any loss of water from sediment during filtering.

Once filtered, sufficient space should be available in the sample bottles for the addition of required preservatives. The bottle caps should then be replaced tightly.

- 4) Samples which are not to be filtered will usually have preservatives in the bottles when received. These bottles should be completely filled with the sample with as little overflow as possible and bottle caps replaced tightly.

If required preservatives have not been received in the bottles, the bottles should be filled with adequate space available in the bottles for the preservative to be added.

- 5) TOX and VOA vials must be filled so that they are "headspace free" (i.e., no air bubbles in the sample bottle). These sample bottles, therefore, need to be over-filled (water tension will maintain a convex water surface in the bottle). The caps for these bottles should be replaced gently, so as to eliminate any air bubbles in the sample. These bottles must then be checked, by inverting the bottles and snapping them sharply with a finger. If any air bubbles appear, open the bottle, add more water, and repeat this process until all air bubbles are absent. Do not empty the bottle and refill. For additional information on filling VOA vials, please see Appendix I, page A7.

- 6) Air space should be left in the coliform bottles, as these samples must be shaken before analysis.

- 7) All sample bottles, once filtered, filled, and preserved as required, must be placed into a refrigerator or cooler with ice until ready to be shipped. Samples must be shipped to ETC or



the local lab the day they are collected. Therefore, allow time at the end of the day to get the collected samples to the courier.

- 8) Never place VOA vials in direct contact with ice packs as they may cause the sample to freeze and break the vial.
- 9) Sample bottles, caps, or septums which fall on the ground before filling, should be thoroughly rinsed with sample water before being used. All circumstances regarding dropped caps or bottles, and their subsequent rinsing and use, must be noted on the Chain-of-Custody (CC1) form.

### 3.3.5 Blanks

Field and trip blanks are used as control or external QA/QC samples to detect contamination that may be introduced in the field (either atmospheric or from sampling equipment), in transit to or from the sampling site, or in the bottle preparation, sample log-in, or sample storage stages within the laboratory. The blanks will also reflect any contamination that may occur during the analytical process.

Trip blanks are the samples of organic free water which are prepared at the same location and time as the preparation of bottles which are to be used for sampling. They remain with the sample bottles while in transit to the site, during sampling, and during the return trip to the laboratory. At no time during these procedures are they opened. Upon return to the laboratory, they are analyzed as if they were another sample, receiving the same QA/QC procedures as ordinary field samples. If these samples are accidentally opened, note that on the Chain-of-Custody form.

Field blanks are prepared in the field (at the sampling site) using empty bottles and the deionized water used for cleaning sampling equipment. Procedures may vary from site to site. Check with the Regional Engineer or Project Manager prior to sampling, and note on

the Field Parameter form if procedures other than those listed below are followed. The well at which the field blank is prepared must be noted in the comments section of the Field Parameter form (CC2).

For non-dedicated sampling equipment, the deionized water is poured into the sampling device (e.g., bailer) after it has been cleaned in preparation for the next sample point. If the parameter of the field blank would normally be filtered, this water should then be placed into a pre-filtration bottle and then filtered. This water, or the unfiltered water, should then be placed into the field blank bottles and the proper preservative added if required.

For dedicated sampling equipment with no filtration, or in-line filtration, the deionized water is exposed to the air, transferred to the field blank bottles, and the proper preservative added if required. If the required filtration is not done in-line, the deionized water should be exposed to the air, poured into pre-filtration bottles, filtered, placed into the field blank bottles, and the proper preservative added if required.

Field and trip blanks are not considered part of the laboratory QA/QC called for in analytical protocols. The latter are used to detect contamination during analytical steps only and to assess the performance of the analytical procedures. Field and trip blanks are required as part of the WMI QA/QC procedures for the overall sampling and analytical program.

In order to maximize the use of monitoring resources, the following guidelines have been established for the use of field and trip blanks:

- 1) For all WMI sites, whose sampling programs involve volatile organics analysis, a minimum of one field blank should be used and analyzed for volatile organics for a project involving three to ten samples. For programs of 11 to 20 samples, a field and trip blank should be used.

For every additional 20 samples or fraction thereof (e.g., for 21-40 field samples), an additional field and trip blank should be used. (See Table 3.10.)

- 2) For CWM sites, whose sampling programs involve volatile organics analyses, a minimum of one field blank should be analyzed for volatile organics for a project involving 1 to 10 samples. For programs of 11 to 20 samples, a field and trip blank should be used. For every additional 10 samples or fraction thereof, an additional field and trip blank should be used (e.g., for 21-30 field samples, two field and trip blanks should be used). (See Table 3.10.)

For programs which do not involve volatile organic analyses, the duplicate well sample will take the place of the field blank.

The above requirements are minimum guidelines. Larger numbers of field and trip blanks may be desired and additional parameters may be analyzed if specified by the Regional Engineer or CWM Manager of QC. Field and trip blank results will be reported in the Technical Report as separate samples using the designations FB or TB in their sample point identifications.

Table 3.10

CWM/WMI FIELD AND TRIP BLANK REQUIREMENTS

#SAMPLES	<u>CWM</u>		<u>WMI</u>	
	FIELD	TRIP	FIELD	TRIP
1-10	1	—	(3-10) 1	—
11-20	1	1	1	1
21-30	2	2	2	2
31-40	3	3	2	2
41-50	4	4	3	3
51-60	5	5	3	3

### 3.3.6 Duplicate Samples (CWM Sites)

The sampling team is responsible for submitting duplicate well samples to the Lab. At each sampling event, a duplicate well sample is obtained from one well, as selected by the site chemist or Regional Engineer. The sample is labelled "X-DUP" and sent to the Lab with the well samples. The actual sample point ID of the duplicate sample should be noted in the comments section of the Field Parameter form (CC2). On subsequent sampling events, a different well will be selected, as before, to be used for obtaining the duplicate sample. All wells should be utilized as duplicates, and a record of these must be maintained on site.

#### 3.3.6.1 Procedures for Filling Bottles for Split Samples and Duplicates

Special procedures are required when split samples or duplicates are to be obtained. Aliquots of water obtained from the well (bailers or pump cycles), must be alternated between sampling teams and/or sample bottles in order to provide samples to each group which will be as representative as possible. Examples of the bottle filling sequences for split samples and duplicates have been listed below.

##### Example 1- Split Sample

Bailer 1 (cycle 1), team 1, VOA vial  
Bailer 2 (cycle 2), team 2, VOA vial  
Bailer 3 (cycle 3), team 1, TOX bottle  
Bailer 4 (cycle 4), team 2, TOX bottle  
Bailer 5 (cycle 5), team 1, TOX bottle  
Bailer 6 (cycle 6), team 2, TOX bottle  
Bailer 7 (cycle 7), team 1, TOC bottle  
etc.

Example 2-Duplicate

Bailer 1 (cycle 1), sample VOA vial  
 Bailer 2 (cycle 2), duplicate VOA vial  
 Bailer 3 (cycle 3), sample TOC bottle  
 Bailer 4 (cycle 4), duplicate TOC bottle  
 Bailer 5 (cycle 5), sample TOX bottle  
 Bailer 6 (cycle 6), duplicate TOX bottle  
 Bailer 7 (cycle 7), sample TOX bottle  
 etc.

3.3.7 Filtration

State guidelines may vary regarding filtration of samples in the field. However, all samples (except those listed below) must be filtered through a 0.45 micron membrane pressure filter unless regulatory requirements specify otherwise.

Procedures Not Requiring Field Filtering

Alkalinity  
 Turbidity  
 Total Suspended Solids, TSS  
 Total Solids  
 Volatile Organics, VOA's  
 Total Organic Halogen, TOX  
 Total \*Heavy Metals  
 Any Other Parameters Listed as Total (excluding TOC)  
 refers to unfiltered samples (If it does not say Total,  
 assume Dissolved)  
 Coliform  
 pH  
 Specific Conductance  
 Oil and Grease

States will specify if they want Total Mercury as opposed to Mercury or Dissolved Mercury. Corporate policy is to filter all heavy metals unless specifically requested otherwise.

Site specific requirements are contained in each addendum for the sampling event. The requirements must be noted on the Chain-of-Custody forms in the column labeled - Filt. (Y/N). Filtering is necessary in order to sample the ions and compounds that are dissolved in solution in the groundwater. Monitoring wells are not as fully developed as drinking water wells and often contain salts and sediment that need to be removed by filtration. If the water is not filtered, the ions and compounds that are naturally present in, or adsorbed on, the suspended particles may be released when samples are preserved and analyzed. This would result in false data for the constituents that actually are present in the groundwater only.

Filtration and preservation of groundwater samples is an integral part of the monitoring program. Improper techniques during this process can destroy the integrity of the sample. Therefore, all possible precautions should be taken to ensure that no contamination sources are introduced during filtration or preservation.

NOTES:

- o Filtering should be performed immediately upon collection of the samples. Filtration should be done in the field. Where this is not possible, it should be completed as soon as possible after the sample has been taken (within two hours), and should be done under the most sanitary conditions available.
- o Refer to Well ID Chart for range of pH and specific conductances, to assist in determining the order of filtering. Any sample which is suspected or known to contain high contamination levels (as identified by the Regional Engineer or Project Manager), are to be filtered last to prevent possible contamination of the clean samples due to use of the same filtering equipment.

- o Filtering apparatus must be dedicated for groundwater only. Do not use any filtering apparatus which is used for other procedures such as EP-TOX.
- o Surface water, private wells, and leachate samples are never filtered.
- o Pre-filtration bottles are not to be reused. Material of and use of pre-filtration bottles must be noted on the Chain-of-Custody form (CC1).

#### Filtration Equipment and Procedures

Following is a list of equipment/requirements necessary for properly filtering and preserving groundwater samples:

- clean bench space with readily accessible sink: this should be secluded away from possible contamination sources, including outside air and inside fumes.
- stainless steel pressure filter holder (1.5 liter reservoir)
- 0.45 um filters (142 mm diameter)
- nitrogen or breathing air (OSHA Class D) tank and regulator
- glass funnels
- large supply of DI water
- misc. supplies (paper towels, tools, markers, etc.)
- parameter checklist as listed on the Chain-of-Custody form to ensure that there is a proper pre-filtration bottle for each analyses or series of analyses that is required for that particular sample
- knowledge of which samples are to be filtered for each sample point
- proper use of preservatives (type and amount)



Following is a step by step procedure for filtering and preserving a typical monitoring well sample:

- 1) Make sure that all filtering apparatus has been completely cleaned with DI water only and dried, and that all pressure fittings are tight.
- 2) Remove the top or reservoir portion of the filter holder and position a new 0.45 um (142 mm diameter) filter on top of the filter support screen, making sure it is flush on all edges. Care should be taken in handling the filter paper, as it is easily torn.
- 3) Place the top or reservoir portion of the filter holder back in place, over the filter paper - and tighten down with the 3 wing-type clamps (finger tight only with equal force).
- 4) Unscrew the insert cover and fill the reservoir with the sample to be filtered, using a clean and dry funnel.
- 5) Screw down the inlet cover and the reservoir securely.
- 6) Use a new sample container.
- 7) Position the new bottle under the outlet valve, beneath the filter holder.
- 8) Open cylinder, regulate pressure to a maximum 40 psi, and pressurize the reservoir--filtration is now in process. Use as minimal amount of air pressure necessary for filtration of the sample.
- 9) When the sample bottle is full or the filtration flow ceases, turn the stopcock to the "off" position. Turn the pressure relief valve to the "on" position to release the pressure.

- 10) Add the proper preservative, which is attached to the bottle or the filtered sample (as stated on the Chain-of-Custody form) and recap the bottle. Invert the bottle several times to mix and the sample. Refer to Appendix I, page A18, for specific procedures on verifying sufficient amounts of preservative were added.
- 11) Record the necessary information on the Field Parameter form and Chain-of-Custody form after every filter change.
- 12) Between samples, disassemble the filter holder and it's components and thoroughly rinse (a minimum of 3 times) with DI water only. Air dry completely or dry with white paper towels.
- 13) Reassemble the filter apparatus and begin process from start (1) as previously discussed.

It is imperative that the proper filtration and preservation techniques be strictly followed. Although at times the process may become tedious and seem trivial, it is of the utmost importance that precise procedures are followed at all times. Otherwise, all the precautions and care taken during purging, sampling, and transport may be destroyed--rendering the subsequent analysis useless. This precise care is necessary, since many of the parameters are measured in the 0-10 ppb range.

#### In-Line Filtration

When using an in-line filter cartridge (i.e., Well Wizard, Gelman) a minimum of three (3) pump cycles of water must be allowed to pass through the filter before obtaining a sample. These filters should only be used for filtering inorganic parameters, unless analytical data is available to support that no sample contamination will occur.

### 3.4 Sample Preservation, Storage and Shipment

#### 3.4.1 Sample Preservation

Samples are to be preserved immediately after filtering or immediately after sample collection if not filtered. TOX which requires no headspace (no air bubbles trapped in the sample), has preservative included in the sample bottle. During filling, do not allow this bottle to overflow any more than necessary to eliminate headspace.

Premeasured amounts of preserving reagents are supplied by ETC along with the sample bottles. The chemicals are contained in small ampules and are attached to the proper bottle for all samples requiring the addition of chemical preservatives in the field. The preservative should be added to the sample bottle after the bottle has been filled. Bottles must not be overfilled, and should be inverted (once capped) to mix the preservative and sample. Refer to Appendix I, page A18 for procedures to insure that samples are correctly preserved. Bottle lids must not be placed on the ground or interchanged between sample bottles. Empty preservative ampules should be returned to the shuttle with the sample bottles.

A listing of preservatives, by analysis, are included in Appendix I for reference only. Do not use a substitute for the chemical preservative supplied, as the reagents are of a special high grade which are metal free. Arrangements should be made with ETC to store additional preservative ampules at the site or the local lab (6 month holding time). If substitutions are made from these stock piles, it should be noted on the Chain-of-Custody form.

#### Temperature Control

Sample temperature should be maintained at 4°C from the time the sample is taken through analysis. Samples should be maintained in temperature regulated refrigerators, in coolers, or shuttles

containing frozen ice packs. Provisions must be made beforehand for facilities to freeze the ice packs. Most solid waste sites have no facilities. The recommended method is to bring coolers and dry ice to the site. The ice packs should only be left in contact with dry ice until it freezes solid.

### 3.4.2 Sample Packing and Storage

#### 3.4.2.1 Checking Sample Codes and Numbers

The sampler must record the sample code (well ID#) in the appropriate blanks of the Chain-of-Custody and Field Parameter forms. It is extremely important that the proper code be recorded utilizing the proper spacing on the form. These codes should be double checked prior to sealing the sample shuttle. Proper sample codes are included in the materials sent to the Local Lab and to the sampler prior to the start of the sampling event on the Part III, Site Summary forms.

In addition, ETC job numbers, if assigned, must be indicated on all bottles and forms, including those from the subcontract lab.

ALL BOTTLES AND CORRESPONDING CHAIN-OF-CUSTODY AND FIELD PARAMETER FORMS MUST HAVE THE SAME SAMPLE POINT ID NUMBER AND LAB OR JCB NUMBER.

All bottles filled from the same sample point at the same time must have identical sample codes and sample numbers. Bottle labels should be double checked for consistency between those being sent to the local lab and ETC. Samples which are split with regulatory agencies should also be checked for consistent sample point ID numbers and for other methods of identification if used by the agency.

### 3.4.2.2 Sample Packing

After collection of the sample and addition of the preservatives (when applicable), the bottles are capped and then placed into the shuttle. The frozen ice packs are then placed into the shuttle. The Chain-of-Custody form and Field Parameter form must be completed. All paper work is then placed into the plastic bag and placed inside the shuttle.

All bottles should be wiped clean prior to placement in the sample shuttle. The bottles and ice packs should be repacked in the same configuration as received. Most importantly, VOA bottles should never be placed directly on the ice packs. The shuttle must be maintained as clean as possible to minimize the potential for contamination. All bottle caps should be checked to ensure they are tight and that they do not become loose upon inserting them into the shuttle. Do not tape the bottle caps! Labels should be taped only if they are loose.

The shipment of samples necessitates the use of containers and packing material designed to prevent breakage and spills. Tight packing materials are provided around each sample bottle. The shuttles must never be shipped without the ice packs or packing sleeves. After the shuttle is packed and locked, the black seal is placed through one of the outside latches and locked. For sample shuttles without seals and latches (or in an emergency), seal with masking tape or security tape and sign the tape appropriately. A combination padlock may also be used if need be, with ETC being informed of the combination after the shuttles are sent. These will provide for Chain-of-Custody procedures.

There are three important reminders for repacking the shuttles:

- 1) Glass should not be packed in contact with glass. Ice packs or packing sleeves should be between these bottles.

- 2) It may not be necessary to freeze, or freeze completely, all of the ice packs. In very cold weather for example, the ice packs should be unfrozen or slushy.
- 3) If the ice packs appear to be leaking, they should be sealed in a zip-lock bag before being returned to the shuttle.

#### 3.4.2.3 Sample Storage

Samples should be stored at 4°C in an enclosed cooler or darkened refrigerator prior to shipment to the laboratory for analysis. Samples should be shipped daily to the laboratory to ensure proper temperature control and not to exceed holding times for samples. A listing of recommended holding times is contained in Appendix I for reference.

#### 3.4.3 Sample Shipment

##### 3.4.3.1 Transportation Arrangements

A member of the sampling team must be designated for arranging sample pickup and transportation to the lab. Sampling schedules should avoid shipment of samples to the local lab on a Friday if at all possible, as holding times may be exceeded over a weekend. This is particularly true for Coliform analyses as few local labs analyze samples on the weekend. ETC accepts samples 7 days per week. Delivery requested on the weekend must be noted on the shipping/packing label for the courier.

Shuttles should be returned by overnight courier. (Refer to contact list in Appendix I.) When contacting the courier for sample transport, provide information as to the shuttle contents. Alert the courier as to potential problems of freezing of the samples in the winter and of melting of ice packs in the summer and note this on the shipping/packing label. The courier must take extra steps to minimize exposure of the shuttles to temperature extremes. The

shuttle must be received at the lab within 80 hours of the time the frozen ice packs were placed into the shuttle. Documentation is required for verification of the time lags and is provided for on the Chain-of-Custody form. Use the pre-addressed shipping label supplied with the shuttles, and remove all old shipping labels.

For sample shuttles from subcontract labs, arrangements are generally made with the subcontract lab for pickup and delivery. Notification of the time for sample pickup is the responsibility of the sampling team.

#### 3.4.3.2 Lab Notification

The following information is required when contacting ETC when the shuttle is shipped:

- 1) the carrier;
- 2) the airbill number;
- 3) project identification number and the quantity of samples and shuttles
- 4) the expected arrival (time and date).

#### 3.4.3.3 Laboratory Sample Receipt

The laboratory will receive and log-in samples and continue to maintain the Chain-of-Custody procedures until the analyses are completed and reported.

Each lab, upon receipt of any sample, will record the following information on the Sample Receipt Log:

- o Presence/absence of custody seal(s);
- o Condition of custody seal (intact, broken);
- o Presence/absence of Chain-of-Custody and Field Parameter forms;
- o Presence/absence of airbills and/or bills of lading documentation for shipment of samples;

- o Condition of samples (intact, broken, obvious movement during shipment, bubbles in VOA/TOX samples or trip blanks, OK, etc.);
- o Presence/absence of sample point ID numbers, where applicable, job numbers on bottles, Chain-of-Custody forms and Field Parameter forms;
- o Notation of discrepancies between numbers on bottles received and those listed on the Chain-of-Custody form;
- o Temperature measurement of shuttle;
- o Description of preservation procedures.

The lab will contact the sampler and Regional Engineer to resolve any deficiencies. It is essential to respond quickly since analyses could be delayed beyond the allowable holding time. Complete documentation and detailed filing procedures are utilized at the sites in order to resolve these problems quickly. Sample results may be delayed by incomplete shipments which do not include all paper work. All Field Forms and Chain-of-Custody Forms must accompany samples. If copies are required for your files, get them made before shipment.

If all samples recorded on the Chain-of-Custody form were received by the lab and there are no problems observed with the sample shipment, lab personnel will sign the Chain-of-Custody form in the "received for laboratory by" box with the date and time. If problems are noted, these will be recorded on the Chain-of-Custody form under Lab Observations, and detailed on the sample receipt log in addition to the normal sign-in procedures.

The following sample information is also documented on the sample log:

- o date received;
- o sample matrix;
- o sample volume;
- o Client sample ID with appropriate order information.



Lab personnel will provide feedback on the condition of the samples, field information and completeness of paperwork. If problems are encountered, the Regional Engineer must be notified.

Copies of the Chain-of-Custody form and Field Parameter forms are included in the analytical report. Documentation of sample condition or incomplete paper work is also reflected on these forms.

#### 3.4.4 Resampling

Resampling of wells between regularly scheduled sampling events should be kept to a minimum. The decision to resample, based on the analytical results, should always be reviewed with the Corporate Environmental Staff. However, in cases where samples are received broken, samples are missing, etc., these should be resampled as soon as possible. The Corporate Environmental Staff should be notified of these occurrences since it may reflect a problem with the shuttles or bottles.

All requests for special sampling are to be approved by Frank Jarke. Clearance can also be obtained from John Baker or Gary Williams, at Oak Brook, if Frank is unavailable. Once a special sampling has been approved, the Regional Engineer, or Project Manager, is responsible for placing the order with ETC or the local lab.

## GLOSSARY

Addendum:	Supplemental work order to a contract.
Alert Levels:	WMI arbitrary groundwater parameter concentrations which, when exceeded, require investigation. Currently used alert level values are the U.S. EPA Drinking Water Standards.
Annular Space:	The concentric area between the inner and outer casing of a well.
Aquifer:	A ground stratum which bears water in a useable quantity.
Casing:	Tubing which isolates the fluid in a well from underground strata.
Casing Volume:	Volume of water in casing before purging.
Conductivity:	A numerical expression of the ability of an aqueous solution to carry an electric current.
Conductivity Standard:	Per "Standard Methods for the Examination of Water and Wastewater" and/or QA/QC Manual.
Dedicated Equipment:	Equipment that is designated for use in one well only, and is often stored within the well itself.
Deionized Water:	Water which has been passed through a column that has been charged with a strongly basic anion-exchange resin in the hydroxyl form and a strongly cation-exchange resin in the hydrogen form.
Distilled Water:	Water prepared by distillation.
EMMS:	Environmental Management Monitoring System.
Field Blank:	A sample of organic free water, which is taken into the field and poured into the device used for sampling and then into the field blank bottles (or poured directly into the field blank bottles.) It is then analyzed as a normal sample as a QC procedure.
Groundwater Elevation:	Height or depth of water from mean sea level.

Headspace: Volume of air in a sample bottle that is trapped between the water surface and the bottle surface.

Hold Times: Maximum length of time allowable between sampling and analysis.

Interim Status: See CFR 40, Section 122.23 for definition.

Meniscus: Curved upper surface in a container.

MSL: Mean Sea Level

NPDES: National Pollutant Discharge Elimination System.

Private Wells: Wells which are in place on private property. These are often drinking water wells.

Purge: Removal of an adequate amount of water from a well, to insure that all stagnant water has been removed, and that the water in the well is representative of the aquifer.

QA/QC: Quality Assurance/Quality Control

Recharge Time: The length of time required after purging, for the water level within a well, to be sufficient for sampling.

Sample Composite: Samples taken over a period of time, which are equally mixed to form one sample.

Sample Point: Location from which sample is obtained.

Sample Matrix: The major constituent of a sample.

Shuttles:

- 1) Rugged carrying cases lined with insulated polyurethane, and with preformed slots for sample bottles. Includes bottles, preservatives, necessary paperwork, seals, blanks and ice packs.
- 2) Rugged coolers (non-styrofoam) or insulated boxes, for holding and transporting samples. Includes bottles, preservatives, necessary paperwork, blanks, and ice packs.

Specific Conductance: Conductivity measured at 25°C.

Static Water Level: Elevation of or depth to water before purging and sampling a well.

Stick-up:

Height of protective well casing from the top of the casing to the cement footing.

Trip Blank:

A sample of organic free water, prepared at the same time and place as the bottles used for sampling, which remains with the sample bottles in transit to the site, during sampling, and during return to the laboratory. At no time is the bottle opened.

IDENTIFICATION CODES

Facility/Site codes: Available through the EMMS

Matrix Codes: 0 - Extracted Sample

1 - Water/Aqueous

2 - Soil/Sediment

3 - Sludge/Complex

4 - Oil/Organic Solvent

5 - Sea Water

Source Codes: W - Well Samples

S - Soil Samples

O - Outfalls

R - River/Stream

T - Treatment Facility

B - Bottom Sediment

I - Surface Impoundment

P - Pretreatment Facility

C - Leachate Collection

L - Lake/Ocean

X - Other (Blank)

CONVERSION CHARTSTemperature

$$0.556(^{\circ}\text{F}) - 17.8 = ^{\circ}\text{C}$$

<u><math>^{\circ}\text{F}</math></u>	<u><math>^{\circ}\text{C}</math></u>	<u><math>^{\circ}\text{F}</math></u>	<u><math>^{\circ}\text{C}</math></u>	<u><math>^{\circ}\text{F}</math></u>	<u><math>^{\circ}\text{C}</math></u>
40.0	4.44	51.0	10.6	61.0	16.1
41.0	5.00	52.0	11.1	62.0	16.7
42.0	5.56	53.0	11.7	63.0	17.2
43.0	6.11	54.0	12.2	64.0	17.8
44.0	6.67	55.0	12.8	65.0	18.3
45.0	7.22	56.0	13.3	66.0	18.9
46.0	7.78	57.0	13.9	67.0	19.4
47.0	8.33	58.0	14.4	68.0	20.0
48.0	8.89	59.0	15.0	69.0	20.7
49.0	9.44	60.0	15.6	70.0	21.1
50.0	10.0				

Length/Depth

<u>Inches</u>	<u>Feet</u>	<u>Inches</u>	<u>Feet</u>
1	0.08	7	0.58
2	0.17	8	0.67
3	0.25	9	0.75
4	0.33	10	0.83
5	0.42	11	0.92
6	0.50	12	1.00

Purge Volumes

$$1 \text{ Casing Volume (Gallons)} = \pi r^2 h \times 7.48$$

where

$$\pi = 3.14$$

$$r = \text{radius of well casing in feet}$$

$$h = \text{height of water column in well in feet}$$

OR For a 2" diameter well casing - 1 casing volume (gal.) = 0.163h  
 for a 4" diameter well casing - 1 casing volume (gal.) = 0.652h

## SPECIFIC CONDUCTANCE CHART

$$K_{25} = K_m (0.02 (25 - T_m)) + K_m$$

$T_m = 10$	$K_{25} = K_m (0.3) + K_m$
$T_m = 11$	$K_{25} = K_m (0.28) + K_m$
$T_m = 12$	$K_{25} = K_m (0.26) + K_m$
$T_m = 13$	$K_{25} = K_m (0.24) + K_m$
$T_m = 14$	$K_{25} = K_m (0.22) + K_m$
$T_m = 15$	$K_{25} = K_m (0.20) + K_m$
$T_m = 16$	$K_{25} = K_m (0.18) + K_m$
$T_m = 17$	$K_{25} = K_m (0.16) + K_m$
$T_m = 18$	$K_{25} = K_m (0.14) + K_m$
$T_m = 19$	$K_{25} = K_m (0.12) + K_m$
$T_m = 20$	$K_{25} = K_m (0.10) + K_m$
$T_m = 21$	$K_{25} = K_m (0.08) + K_m$
$T_m = 22$	$K_{25} = K_m (0.06) + K_m$
$T_m = 23$	$K_{25} = K_m (0.04) + K_m$
$T_m = 24$	$K_{25} = K_m (0.02) + K_m$
$T_m = 25$	$K_{25} = K_m (0.00) + K_m$

Note:

$K_m$  = Conductivity Measurement

$T_m$  = Temperature Measurement

$K_{25}$  = Specific Conductivity

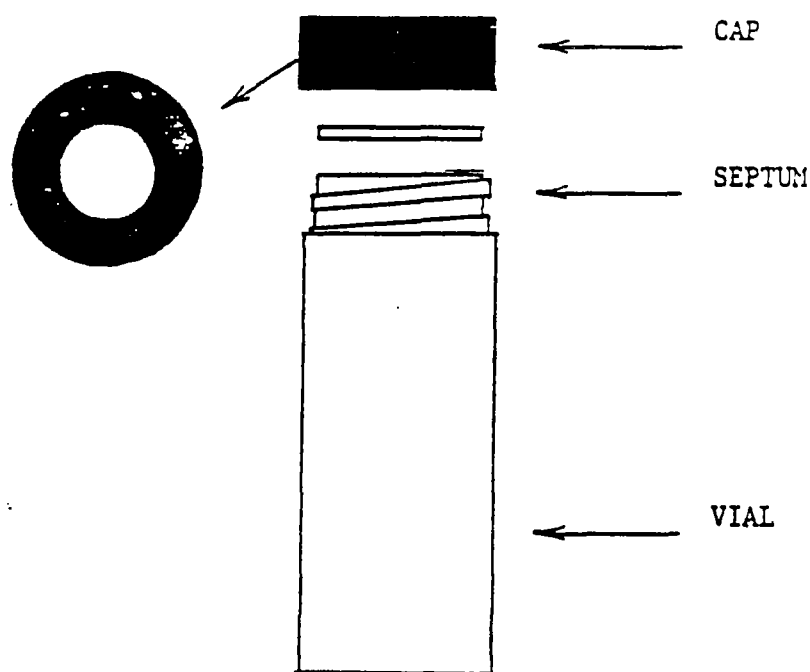
## PROPER SAMPLING PROCEDURE

## 40 ML. VOA VIALS

Careful sampling techniques must be used to obtain a representative sample for analysis of volatile organic compounds (VOA's). As the name suggests, these compounds will volatilize from the water sample upon exposure to air. Therefore, this exposure time must be minimized. Sample contamination may easily occur if the samples are exposed to a source of volatile organics. Extra quality control procedures are used to avoid this possibility and to detect if contamination has occurred.

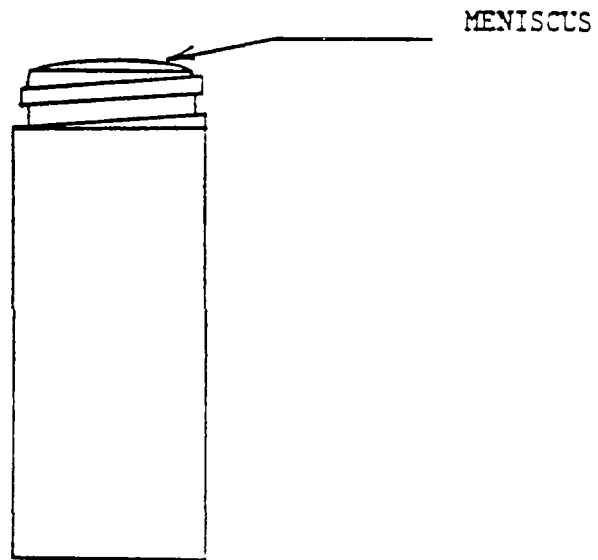
Step 1: Carefully remove teflon septum cap being careful not to contact cap with potential contaminants.

Note: Vial must not be opened prior to use in sampling. If vial and/or cap appears defective, call ETC. The vial should be open for a minimum amount of time (no longer than 3 minutes).

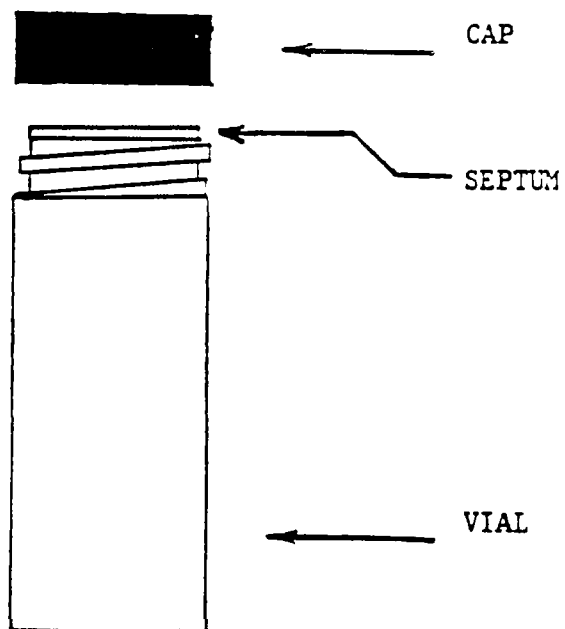




- Step 2: Carefully fill vial with sample until meniscus (mound of water) forms on top. Avoid agitating sample as this may cause volatiles to vaporize.



- Step 3: Carefully replace septum and cap on meniscus. This will force a small amount of water off the top. Check sample for air bubbles. If bubbles are present, remove cap, top off sample, and repeat Step 3.



ENVIRONMENTAL MONITORING PROGRAM MANAGEMENT PERSONNEL

(May 1986)

WMI Director of Environmental Management	Gary Williams - Oak Brook
WMI Manager of Monitoring	John Baker - Oak Brook
WMI Assistant Manager of Monitoring	Frank Jarke - Oak Brook
WMI Sampling Coordinator	Frank Perugini - Oak Brook
EMMS Technical Assistant	Saeed Karimi - Oak Brook
CWM Director of Environmental Operations	Johan Bayer - Oak Brook
CWM Manager of Environmental Compliance	Dana Lockwood - Oak Brook
CWM Training Officer	Lee Parker - Oak Brook
CWM Director of Analytical Chemistry (QA/QC)	Mark Marcus - Riverdale
CWM Manager of Quality Control	Gene Klesta - Riverdale
Lead Lab	ETC 284 Raritan Center Pkwy. Edison, NJ 08818 (201) 275-5600

Waste Management, Inc.  
3003 Butterfield Road  
Oak Brook, IL 60521  
(312) 654-8800

Chemical Waste Management, Inc.  
Riverdale Center  
150 W. 137th Street  
Riverdale, IL 60627  
(312) 841-8360

List of Contacts

Regional Engineer:

\_\_\_\_\_  
Name\_\_\_\_\_  
Address\_\_\_\_\_  
City, State, Zip\_\_\_\_\_  
Phone No.

Site Manager:

\_\_\_\_\_  
Name

Site Chemist:

\_\_\_\_\_  
Name

Lab Technician:

\_\_\_\_\_  
Name\_\_\_\_\_  
Site Address\_\_\_\_\_  
City, State, Zip\_\_\_\_\_  
Phone No.

Consultant:

\_\_\_\_\_  
Company

Personnel:

\_\_\_\_\_  
Name\_\_\_\_\_  
Name\_\_\_\_\_  
Company Address\_\_\_\_\_  
City, State, Zip\_\_\_\_\_  
Phone No.

Lead Contract Lab:

\_\_\_\_\_  
Company Name

Personnel:

\_\_\_\_\_  
Name\_\_\_\_\_  
Name\_\_\_\_\_  
Company Address\_\_\_\_\_  
City, State, Zip\_\_\_\_\_  
Phone No.

Sampling Trainer:

\_\_\_\_\_  
Name  
\_\_\_\_\_  
Company Name  
\_\_\_\_\_  
Address  
\_\_\_\_\_  
City, State, Zip  
\_\_\_\_\_  
Phone No.

Local Lab:

\_\_\_\_\_  
Company Name  
\_\_\_\_\_  
Contact  
\_\_\_\_\_  
Company Address  
\_\_\_\_\_  
City, State, Zip  
\_\_\_\_\_  
Phone No.

ECO:

\_\_\_\_\_  
Name  
\_\_\_\_\_  
Address  
\_\_\_\_\_  
City, State, Zip  
\_\_\_\_\_  
Phone No.

Courier:

\_\_\_\_\_  
Company  
\_\_\_\_\_  
Contact  
\_\_\_\_\_  
Phone No.

Well Wizard trouble-shooting number (800) 624-2026

# **RECOMMENDATION FOR SAMPLING AND PRESERVATION OF SAMPLES ACCORDING TO MEASUREMENT<sup>(1)</sup>**

<u>Measurement</u>	<u>Vol. Req. (ml)</u>	<u>Container<sup>2</sup></u>	<u>Preservative<sup>3,4</sup></u>	<u>Holding Time<sup>5</sup></u>
<b>100 <u>Physical Properties</u></b>				
Color	50	P,G	Cool, 4°C	48 Hrs.
Conductance	100	P,G	Cool, 4°C	28 Days
Hardness	100	P,G	HNO <sub>3</sub> to pH < 2	6 Mos.
Odor	200	G only	Cool, 4°C	24 Hrs.
pH	25	P,G	None Req.	Analyze Immediately
Residue				
Filterable	100	P,G	Cool, 4°C	7 Days
Non- Filterable	100	P,G	Cool, 4°C	7 Days
Total	100	P,G	Cool, 4°C	7 Days
Volatile	100	P,G	Cool, 4°C	7 Days
Settleable Matter	1000	P,G	Cool, 4°C	48 Hrs
Temperature	1000	P,G	None Req.	Analyze Immediately
Turbidity	100	P,G	Cool, 4°C	48 Hrs.
<b>200 <u>Metals</u></b>				
Dissolved	200	P,G	Filter on site HNO <sub>3</sub> to pH < 2	6 Mos.
Suspended	200		Filter on site	6 Mos. <sup>(6)</sup>
Total	100	P,G	HNO <sub>3</sub> to pH < 2	6 Mos

<u>Measurement</u>	<u>Vol. Req. (ml)</u>	<u>Container<sup>2</sup></u>	<u>Preservative<sup>3,4</sup></u>	<u>Holding Time<sup>5</sup></u>
Chromium <sup>6</sup>	200	P.G	Cool. 4°C	24 Hrs.
Mercury Dissolved	100	P.G	Filter HNO <sub>3</sub> to pH < 2	28 Days
Total	100	P.G	HNO <sub>3</sub> to pH < 2	28 Days
<b>300 <u>Inorganics, Non-Metallics</u></b>				
Acidity	100	P.G	Cool. 4°C	14 Days
Alkalinity	100	P.G	Cool. 4°C	14 Days
Bromide	100	P.G	None Req.	28 Days
Chloride	50	P.G	None Req.	28 Days
Chlorine	200	P.G	None Req.	Analyze Immediately
Cyanides	500	P.G	Cool. 4°C NaOH to pH > 12 0.6g ascorbic acid <sup>6</sup>	14 Days <sup>7</sup>
Fluoride	300	P.G	None Req.	28 Days
Iodide	100	P.G	Cool. 4°C	24 Hrs
Nitrogen				
Ammonia	400	P.G	Cool. 4°C H <sub>2</sub> SO <sub>4</sub> to pH < 2	28 Days
Kjeldahl, Total	500	P.G	Cool. 4°C H <sub>2</sub> SO <sub>4</sub> to pH < 2	28 Days
Nitrate plus Nitrite	100	P.G	Cool. 4°C H <sub>2</sub> SO <sub>4</sub> to pH < 2	28 Days
Nitrate <sup>8</sup>	100	P.G	Cool. 4°C	48 Hrs
Nitrite	50	P.G	Cool. 4°C	48 Hrs.

<u>Measurement</u>	<u>Vol. Req. (ml)</u>	<u>Container<sup>2</sup></u>	<u>Preservative<sup>3,4</sup></u>	<u>Holding Time<sup>5</sup></u>
Dissolved Oxygen Probe	300	G bottle and top	None Req.	Analyze Immediately
Winkler	300	G bottle and top	Fix on site and store in dark	8 Hours
Phosphorus Ortho- phosphate, Dissolved	50	P,G	Filter on site Cool, 4°C	48 Hrs.
Hydrolyzable	50	P,G	Cool, 4°C H <sub>2</sub> SO <sub>4</sub> to pH < 2	28 Days
Total	50	P,G	Cool, 4°C H <sub>2</sub> SO <sub>4</sub> to pH < 2	28 Days
Total, Dissolved	50	P,G	Filter on site Cool, 4°C H <sub>2</sub> SO <sub>4</sub> to pH < 2	24 Hrs.
Silica	50	P only	Cool, 4°C	28 Days
Sulfate	50	P,G	Cool, 4°C	28 Days
Sulfide	500	P,G	Cool, 4°C add 2 ml zinc acetate plus NaOH to pH > 9	7 Days
Sulfite	50	P,G	None Req.	Analyze Immediately
400 <u>Organics</u>				
BOD	1000	P,G	Cool, 4°C	48 Hrs.
COD	50	P,G	Cool, 4°C H <sub>2</sub> SO <sub>4</sub> to pH < 2	28 Days
Oil & Grease	1000	G only	Cool, 4°C H <sub>2</sub> SO <sub>4</sub> to pH < 2	28 Days
Organic carbon	25	P,G	Cool, 4°C H <sub>2</sub> SO <sub>4</sub> or HCl to pH < 2	28 Days
Phenolics	500	G only	Cool, 4°C H <sub>2</sub> SO <sub>4</sub> to pH < 2	28 Days

<u>Measurement</u>	<u>Vol. Req. (mL)</u>	<u>Container</u> <sup>2</sup>	<u>Preservative</u> <sup>3,4</sup>	<u>Time</u>
MBAS	250	P,G	Cool, 4°C	48 hrs.
NTA	50	P,G	Cool, 4°C	24 hrs.
General Organics	2,000	G, only (amber) w/Teflon liner	Cool, 4°C	Extract within 7 days, analyze within 40 days
Pesticides/ Herbicides	1,000	G, only (amber) w/Teflon liner	Cool, 4°C	Extract within 7 days, analyze within 40 days
Volatile Organics (VOA)	40 mL vial w/septum caps	G, only	Cool, 4°C	14 days



1. More specific instructions for preservation and sampling are found with each procedure as detailed in this manual. A general discussion on sampling water and industrial wastewater may be found in ASTM, Part 31, p. 72-81 (1976) Method D-3370.
2. Plastic (P) or Glass (G). For metals, polyethylene with a polypropylene cap (no liner) is preferred.
3. Sample preservation should be performed immediately upon sample collection. For composite samples, each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.
4. When any sample is to be shipped by common carrier or sent through the United States Mails, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring such compliance. For the preservation requirements of Table 1, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid (HCl) in water solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid (HNO<sub>3</sub>) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) in water solutions at concentrations of 0.35% by weight or less (pH about 1.15 or greater); Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.30 or less).
5. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still considered valid. Samples may be held for longer periods only if the permittee, or monitoring laboratory, has data on file to show that the specific types of sample under study are stable for the longer time, and has received a variance from the Regional Administrator. Some samples may not be stable for the maximum time period given in the table. A permittee, or monitoring laboratory, is obligated to hold the sample for a shorter time if knowledge exists to show this is necessary to maintain sample stability.
6. Should only be used in the presence of residual chlorine.
7. Maximum holding time is 24 hours when sulfide is present. Optionally, all samples may be tested with lead acetate paper before the pH adjustment in order to determine if sulfide is present. If sulfide is present, it can be removed by the addition of cadmium nitrate powder until a negative spot test is obtained. The sample is filtered and then NaOH is added to pH 12.
8. Samples should be filtered immediately on-site before adding preservative for dissolved metals.
9. For samples from non-chlorinated drinking water supplies conc. H<sub>2</sub>SO<sub>4</sub> should be added to lower sample pH to less than 2. The sample should be analyzed before 14 days.

## SAMPLE PRESERVATION (ACID/BASE) PROCEDURES

## Proper Presentation (acid/base)

In order to insure that a sufficient amount of preservative (acid or base) has been added to a sample, a method has been established for checking the pH of a sample with as minimal disturbance possible to the sample.

Required equipment includes: Capillary tubes  
pH paper  
Extra preservative vials (supplied by ETC  
or the local lab)

Once a sample has been preserved, with the preservative supplied by ETC or the local lab, and inverted several times to mix the sample, the following procedures should be used:

1. Open sample bottle.
2. Insert one capillary tube into the sample bottle, limiting the length of time of insertion into the sample until the tube is filled. Do not plug the end of the capillary tube. The water will rise into this tube on its own.
3. Close sample bottle.
4. Place the capillary tube end onto a piece of pH paper and observe the pH value.
- 5a. If the pH is less than 2 (for acid preservation) or greater than 12 (for base preservation), the sample has been adequately preserved.
- 5b. If the proper pH has not been achieved, an additional preservative vial, the same type as originally used, should be emptied into the sample, mixed, and steps 1-5 should be repeated.

## RECOMMENDED FIELD EQUIPMENT/SUPPLIERS

Water Level Indicator

Slope Indicator Co.  
3668 Alborn Place  
P.O. Box C-30316  
Seattle, WA 98103  
(206) 633-3073

Soiltest, Inc.  
2205 Lee Street  
Evanston, IL 60202  
(312) 869-5500

In-Situ, Inc.  
209 Grand Avenue  
Laramie, WY 82070  
(307) 742-8213

pH Meter

Beckman Instruments, Inc.  
Fullerton, CA  
(714) 871-4848

Model 21 pH Meter	12314
Epoxy body electrode	39520
Electrode cable	597578
ATC probe	598115

Combination Temp./pH/SC Meter

Cambridge Scientific Industries  
P.O. Box 265  
Moose Lodge Road  
Cambridge, MD 21613

Comb. Temp/pH/SC Meter	301353
pH electrode	102927
Buffer kit	102953

Filtration Apparatus

MFS: Micro Filtration Systems  
Dublin, CA  
(415) 828-6010

In-Line -  
Flat stainless 142mm pressure holder  
Model #Ks142ST 302100

Reservoir -

Reservoir stainless 142 mm pressure holder (1.5 liter capacity)  
Model #KST142 302300

Filter Paper -

Cellulose nitrate filter, 0.45 um pore size, 142 mm diameter A045A142C

QED Environmental Systems, Inc.  
P.O. Box 3726  
Ann Arbor, MI 48106  
(313) 995-2547

In-Line disposable Sample Pro<sup>TM</sup> filters -  
0.45 Micron High capacity field filter FF8000

Dedicated Bladder Pumps

Q.E.D. Environmental Systems, Inc.  
1254 N. Main Street  
Ann Arbor, MI 48017  
(800) 624-2026

Controller Units for Bladder Pumps

GeoTech Environmental Equipment, Inc.  
1441 W. 46th Ave.  
Denver, CO 80211  
(303) 433-7101

Pneumatic logic unit 5504  
Electrical pneumatic logic unit 5505

QED Environmental Systems, Inc.  
P.O. Box 3726  
Ann Arbor, MI 48106

Sample Pro Electronic Controller 350  
Pneumatic controller (automatic) 3013

Gasoline driven driver controller 3111

Bailers

Diedrich Drilling Equipment, Inc.  
2008 Ohio Street  
LaPorte, IN 46350  
(800) 348-8809

Timco Manufacturing Co.  
851 Fifteenth Street  
Prairie du Sac, WI 53578  
(608) 643-8534

Galter Corporation  
Jonathon Industrial Center  
Chasra, MN 55318  
(612) 448-6717

Submersible Pumps

GRUNDFOS Pumps Corporation  
2555 Clouis Avenue  
Clouis, CA 93612  
(209) 299-9741

Retrofitted with teflon by:

PFC Equipment, Inc.  
7409 Jolly Lane  
Minneapolis, MN 55470  
(612) 425-7890

Safety Equipment

Powder-free Gloves  
Glove Liners  
Boots and Tyvek Suit

Shamrock Industrial Glove  
920 West Byers Place  
Denver, Colorado 80223  
(303) 778-0667

SAMPLING TEAM LAB  
AND STORAGE BUILDING

A designated sampling team lab and storage building is required for all facilities for environmental sampling. This building is intended to isolate the environmental samples and equipment from possible contamination sources, such as the site lab, site pollutants, etc. Due to the low levels of detection required by the regulatory agencies, every possible precaution must be utilized to preserve the integrity of the samples from air-borne or direct contact contamination. The samples, as well as all sampling equipment and dedicated lab equipment, must be isolated. No leachate or sales samples are to be stored or placed in this building.

The sampling team lab and storage building has a "dirty room" and a "clean room" concept. This design is intended to minimize most contaminants which are present on site from being introduced into the samples during filtration and preservation, while also providing ample storage space for all sampling equipment and shuttles. All entry to the building is made through the "dirty room", which acts as a filter for most site contaminants and dirt, by trapping these materials before entry to the "clean room".










This lab and storage building will need to be cleaned thoroughly with DI water before each use. Tap water may be used to remove the excess dirt, but must then be thoroughly rinsed with DI water.

The following list provides some of the uses for the "dirty room" and "clean room" of the sampling team lab and storage building.

Sampling Team Lab and StorageBuilding Use

<u>"DIRTY ROOM"</u>	<u>"CLEAN ROOM"</u>
Receiving shuttles	Place ice packs in freezer
Open and inspect shuttles	Calibrate pH and specific conductivity meters
Reseal shuttles and store until required	Store pre-filtration bottles
Return of shuttles with samples	Store post-filtration bottles
Clean shuttles	Receive samples
Clean sampling equipment	Measure pH and specific conductivity
Store sampling equipment	Filter samples
Store boots, rain gear, etc.	Preserve samples
Repack shuttles	Place samples in refrigerator
	Complete field form
	Store filtering equipment
	Store extra preservatives and field forms
	Store pH and specific conductivity meters
	Store pH and specific conductivity standards

SUGGESTED SAMPLING TEAM LAB AND STORAGE BUILDINGKEY TO SYMBOLS

	Fire Extinguisher
	Nitrogen Tank or Compressed Air Source
D.I.	DI Water
	Sealed Window
	Drawers
	Cabinets with Shelves
	Emergency Exit
	Floor Drain
	First Aid Kit
	Sink

Building must have its own air conditioning and heating system.

Outside door must be locked when building is not in use.

Refrigerator, with freezer section, must be laboratory approved.

All windows must be sealed.

Slashed lines indicate divisions under countertops.

All garbage cans are located under countertops.

Wall storage cabinets may also be added to the labs (i.e., on center wall above countertops, along outside walls in clean area).

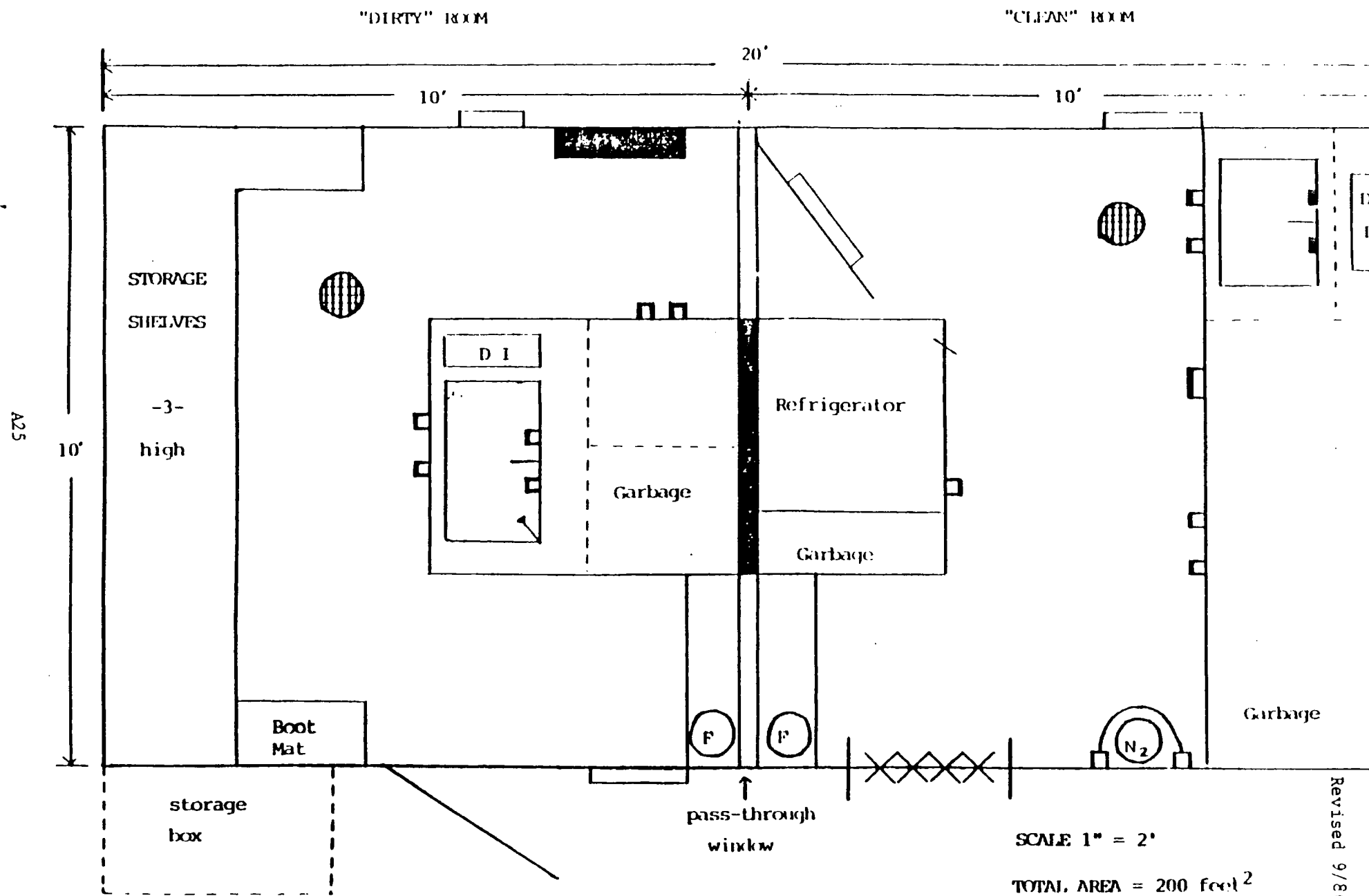
Sinks must be approximately 1½ feet deep.

Sink in "dirty" room must have a spray nozzle.

Gasoline and oil must be kept outside of this building. A small storage box may be placed as noted on the diagram.



# SUGGESTED SAMPLING METAL AND STORAGE BUILDING



APPENDIX E  
ANALYTICAL METHODS USED BY ETC

August 1987

873-2096

Golder Associates

## Methodology For Analysis of Appendix IX Parameters

The methods employed in the analysis of specific compounds in Appendix IX are based on the second edition (July 1982) of EPA Manual SW-846 "Test Methods for Evaluating Solid Waste". Since the manual is deficient in details on how the complete analysis of Appendix IX compounds can be performed, we devised an analytical scheme that divides the compounds into the nine categories as stated in the introduction. Presently, standard reference materials are available for all compounds except for three. These compounds have been footnoted in the results tables. In the GC/MS analyses we were able to search for the specific compounds that did not have corresponding reference standards by using standard spectra from the literature.

In each category rigid compliance with the instrument parameters and performance criteria of established EPA methods, such as those in methods 624 and 625, was achieved before any sample analysis was initiated. (Similar criteria do not exist in SW846.) For GC/MS analysis where standards were available, identification was performed using relative retention times, the relative abundance of three characteristic ions and the abundance ratios. The entire mass spectrum was reviewed to confirm each identification. Quantitative analysis was performed using an internal standard with a single characteristic ion. When compounds without corresponding reference standard were identified, they were quantified assuming the same response factor as the internal standard.

### *Volatile Compounds by Purge and Trap GC/MS*

For the analysis of purge and trap Volatile compounds, Methods 8240 and 5030 were used. The analysis can be summarized as follows: Helium is bubbled through a 5 ml water sample contained in a specially designed purging chamber at ambient temperature. The purgeable volatile organic compounds are transferred from the aqueous phase to the vapor phase. The vapor is swept through a sorbent column where the organic components are trapped. After the purge cycle is complete, the sorbent column is heated and backflushed with helium to desorb the organic purgeables onto a gas chromatographic column. The gas chromatograph is temperature programmed to separate the purgeable mixture. The separated purgeable components are then identified and quantitated using a computerized mass spectrometer.

### *Water Soluble Compounds by Direct Aqueous Injection GC/MS*

For the analysis of water soluble compounds, 5ul of aqueous sample was injected directly into the GC/MS system. The chromatographic column employed in the procedure is the same column used for purge and trap analysis. MS scanning was begun prior to sample injection to capture mass intensity data for early eluting compounds. The GC oven temperature program used was that specified in procedure 8240.

### *Extractable Acid, Base/Neutral and Pesticide Compounds by GC/MS*

For the analysis of the Acid, Base/Neutral and Pesticide compounds in water, Methods 3510 and 8270 were used. The analysis can be summarized as follows: a measured volume of sample, approximately 1 liter, is extracted with an aliquot of methylene chloride without pH adjustment and then the sample is adjusted to a pH greater than 11 and extracted with another aliquot of methylene chloride. These two aliquots were combined. The pH of the sample is then adjusted to a value less than 2 and extracted with another aliquot of methylene chloride. A separatory funnel or continuous extractor is used to perform the extractions. The two extracts are dried and concentrated to a 1ml final volume. The extracts are then combined just prior to injection into a GC/MS instrument.

#### *GC Analysis of Herbicides and Pesticides/PCB's*

The methods employed in the analysis of your sample for herbicides and pesticides are established EPA methods taken from the "Manual of Analytical Methods for the Analysis of Pesticides in Humans and Environmental Samples," June, 1980 and methods 8080, 8140 and 8150.

The herbicide method can be summarized as follows: A measured volume of sample, approximately 500-1000 ml, to which sodium sulfate has been added, is acidified and extracted with methylene chloride. The methylene chloride extract is evaporated to dryness, and the residue is derivatized with diazomethane and injected into a gas chromatograph equipped with a <sup>63</sup>Ni electron capture detector.

The pesticide/PCB method can be summarized as follows: A measured volume of sample, approximately 500ml, is extracted with methylene chloride. The extract is dried and concentrated to a final volume of 1ml and injected into a gas chromatograph equipped with a <sup>63</sup>Ni electron capture detector and Flame Photometric detector in phosphorus mode.

#### *Analysis of Metals*

The determination of metals in aqueous samples is performed according to the methods published by EPA in "Methods for Chemical Analysis of Water and Wastes," EPA-600/4-79-020, March, 1979, and the inorganic methods in SW846. Arsenic, selenium and thallium are determined by furnace AA; silver, aluminum, barium, beryllium, boron, cadmium, calcium, chromium, copper, cobalt, iron, magnesium, manganese, molybdenum, nickel, lead, sodium, antimony, tin, titanium, vanadium, and zinc are determined by ICP emission. The determination of mercury is performed by cold vapor AA.

#### *Conventional*

Total cyanide analysis is performed using Method 9010. Total fluoride analysis is performed using Standard Methods 413E, complexone with distillation.

#### *Analysis of Tetra through Hexachlorodibenzodioxins and Furans*

The method employed in the analysis of water samples for total tetra through hexachlorodibenzodioxins and furans is EPA Method 613 (Reference EPA-600/4-82-057) for the extraction, followed by the additional clean-up procedures found in "Dioxin Analysis - Soil/Sediment Matrix Multi-Concentration; Selected Ion Monitoring (SIM) GC/MS Analysis with Jar Extraction Procedure" issued by the USEPA. The sample extracts are then analyzed by electron impact GC/MS with a direct capillary interface. A 50 meter fused silica capillary column was used for the analysis.

The method can be summarized as follows: 50 ng of <sup>14</sup>C-labeled 2,3,7,8-TCDD, 50 ng of <sup>14</sup>C labeled 2,3,7,8 TCDF, and 10 ng of <sup>125</sup>I-labeled 2,3,7,8-TCDD are spiked into 1000 ml of water sample. The water sample is serially extracted with methylene chloride. The serial extracts are combined, concentrated to 1ml and exchanged with hexane. Column chromatographic procedures are used to help eliminate sample components that may interfere with detection and measurement of chlorinated dioxins and furans. A final clean-up of the sample extract is performed by using the following procedure: Prepare 18% Carbopak C on Celite 545<sup>TM</sup> by thoroughly mixing 3.6 grams of Carbopak C (80/100 mesh) and 16.4 grams of Celite 545<sup>TM</sup> in a 40ml vial. Activate at 130°C for six hours. Store in a desiccator. Prepare a column using a standard size (5-3/4 inches long by 7.0 mm o.d.) disposable pipet fitted with a small plug of glass wool. Using a vacuum aspirator attached to the pointed end of the pipet, add the carbopak/celite mix until a 2cm column is obtained. Preequilibrate the column with 2-ml of toluene followed by 1-ml of 75:20:5 methylene chloride/methanol/benzene, 1-ml of 1:1 cyclohexane in methylene chloride and 2-ml of hexane. While the column is still wet with hexane add the extract obtained from above. Elute the column sequentially with two 1-ml aliquots of hexane, 1-ml of 1:1 cyclohexane in methylene chloride, and 1-ml of 75:20:5 methylene chloride/methanol/benzene. Next collect the PCDD/PCDF (polychlorodibenzodioxin/polychlorodibenzofuran) fraction by elution with 2-ml of toluene. The sample is stored at this point in a freezer until GC/MS analysis. Just before analysis begins, reconstitute the residue with 10ul of isooctane.

The sample extracts were analyzed using a gas chromatograph equipped with a 60 meter DB-5 fused silica capillary column which is interfaced to an electron impact quadrupole mass

spectrometer. The mass spectrometer is operated in the selected ion mode. Key ions in the spectrum of tetra- through hexachlorodibenzodioxins, furans, and the  $^{13}\text{C}$ -labelled internal standards are monitored during the analytical process. The GC/MS system parameters, the key ions and ion groups are summarized in Table 1.

The presence of a chlorinated dioxin or furan is confirmed if the key ions of the detected isomer are m/zed within the same MS scan and their relative abundances are within 0.1 relative abundance units of the theoretical values. Each detected isomer is quantitated using the areas of the key ions of that isomer, the area of the  $^{13}\text{C}$ -labelled dioxin or furan internal standard and a response factor generated from known concentration standards of tetra- through octa-chlorodioxins and furans. Each detected isomer is reported as a separate line item on the report table. The reported isomers are differentiated by their listed retention times.

TABLE 1

IONS MONITORED

Group 1, Retention Time: 20.0-32.0 minutes

A. Tetrachlorodibenzodioxin (TCDD)

m/z 257

m/z 320

m/z 322

B. Tetrachlorodibenzofuran (TCDF)

m/z 241

m/z 304

m/z 306

C. <sup>13</sup>C 2,3,7,8 TCDD (Internal Standard)

m/z 332

m/z 334

D. <sup>13</sup>C 2,3,7,8 TCDF (Internal Standard)

m/z 316

m/z 318

E. <sup>37</sup>Cl 2,2,7,8 TCDD (Surrogate)

m/z 329

Group 2, Retention Time: 32.0-36.1 minutes

A. Pentachlorodibenzodioxin

m/z 291

m/z 354

m/z 356

B. Pentachlorodibenzofuran

m/z 275

m/z 338

m/z 340

C. Hexachlorodibenzodioxin

m/z 327

m/z 390

m/z 392

D. Hexachlorodibenzofuran

m/z 311

m/z 374

m/z 376

II. MASS DWELL TIME: 60 milliseconds/amu

### III GAS CHROMATOGRAPH PARAMETERS

Injector Temperature: 250°C

Column Coating: DB-5

Film Thickness: 0.25  $\mu$ m

Column Dimensions: 60 m x 0.25 mm I.D.

Carrier Gas: Helium

Linear Velocity of Carrier Gas: 24 cm/sec

Temperature Program: 150-240°C, @ 4°C/min

Interface Temperature: 250°C

### MASS SPECTROMETER PARAMETERS

Ion Source Temperature: 265°C

Multiplier Voltage: 2600 volts

Emission Current: 300 microamps

## APPENDIX II

### QUALITY ASSURANCE DATA

1. Internal Standard Recovery Summary Data Table 2
2. Method Blank Data
3. Method Spike Data
4. Matrix Spike Data
5. Replicate Data



## Summary of Quality Assurance/Quality Control Procedures (QA/QC)

ETC bases its quality assurance protocols on the following government guidelines:

- . "Handbook for Analytical Quality Control in Water and Wastewater Laboratories", EPA-600/4-79-019, March 1979;
- . National Enforcement Investigation Center Policies, and Procedures manual; EPA-330/9/78/001-R, Revised May 1986;
- . The recommended guidelines for EPA Methods 624 and 625. (Federal Register, December 3, 1979, updated on October 26, 1984);
- . "Methods for Chemical Analysis of Water and Wastewater" EPA-600/4-79-020, March 1983;
- . "Manual of Analytical Methods for the Analysis of Pesticides in Humans and Environmental Samples," EPA 600/8-80-038, June 1980;
- . Organic Analysis: Multi-media, Multi Concentration-IFB July, 1985;
- . Inorganic Analysis: Multi-media, Multi Concentration-IFB July, 1985;
- . Dioxin Analysis: Soil/Sediment And Water Matrices, Multi-Concentration; Selected Ion Monitoring with Jar Extraction Procedure-IFB WA86-K357.

However, ETC has modified our protocols to provide a higher level of QA/QC than the guidelines require. For example, ETC analyzes a higher than required number of quality control samples and pays especially careful attention to the certification of the "reference standard" compounds used in analysis. Below are listed the key QA/QC elements for the methods ETC uses for private sector analysis. QA/QC requirements may vary for specific contracts, i.e. IFB/CLP or New Jersey DEP. Contractural procedures are separately specified.

### Analysis of Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry

- Each batch consists of customer samples, one blank sample, one spiked blank, one spiked sample and one replicated customer sample.
- Matrix spike duplicate is performed in place of a replicate sample for CLP criteria.
- Three surrogate compounds are added to each sample in the batch.
- Each GC/MS is checked and retuned, every 12 hours to ensure that its performance on bromofluorobenzene (BFB) meets the EPA criteria.
- A calibration curve for quantitation is prepared using a mixture of Volatile Organic Priority Pollutant "standards" at 3 to 5 different concentrations and using a mixture of 3 internal standards at a constant concentration. -
- The calibration curve is verified with a mixture of priority pollutant standards every day. If the response factors vary greater than 25%, the instrument must be recalibrated.

### Analysis of Organic Compounds Extracted in Acid or Base/Neutral Solutions by Gas Chromatography/Mass Spectrometry

- Each batch consists of customer samples, one blank sample, one spiked blank (for water matrices), one sample spiked with the priority pollutant standard mixture and a replicated customer sample.
- Matrix spike duplicate is performed in place of a replicate sample for CLP criteria.
- Three surrogate compounds are added to each sample in the batch for Base/Neutral analysis.
- Three surrogate compounds are added to each sample in the batch for Acid analysis.
- Each GC/MS is checked and retuned, every 12 hours to ensure that its performance on decafluorotriphenylphosphine (DFTPP) meets the EPA criteria.
- A calibration curve for quantitation is prepared using a mixture of standards composed of either the Organic Acid or Base/Neutral Extractable compounds at 3 to 5 concentrations and using five internal standards for quantitation.

### Analysis of Metals

#### All Samples

- Each batch consists of customer samples, one blank, one spiked blank, one spiked sample and one replicated customer sample.
- A 4-point standard calibration is run. A regression analysis is used to construct the calibration curve.
- 3 levels of EPA known reference samples are run for instrument calibration.
- 3 levels of independent reference standards are used to check the accuracy of calibration standards.
- One blank is analyzed every 10 samples.
- One check standard is analyzed every 10 samples to validate the normal calibration.
- Interference elements are run to correct for known interferences.
- For each sample analysis that requires the use of the "method of additions" technique, a 3-point calibration is performed using U.S. EPA "Methods for Chemical Analysis of Water and Wastes, 1983". Results are obtained using linear regression analysis. Any regression with a coefficient of correlation below 0.995 is considered suspect, necessitating review of calibration data or sample re-analysis.
- In constructing the normal calibration curves the lowest concentration levels used are values greater than or equal to 5 times the Instrument Detection Limit (IDL).

### Analysis of Pesticides, Herbicides and PCB's by Gas Chromatography

#### All Samples

- Each batch is grouped according to the type of analysis to be performed
- Each batch consists of customer samples, one blank sample, one spiked blank (for water matrices) and a replicated customer sample.
- The instrument is calibrated each run with three standards.

### Analysis of Cyanides, Phenols, Fluoride, Chloride, Nitrate and Nitrite

- All parameters are analyzed using a Technicon Autoanalyzer II GT.
- A standard curve is developed in every analytical batch.
- Two sets of 5 calibration standards are analyzed at the beginning of a batch, with an inter-sample check standard run every 10 samples.
- Each batch consists of customer samples method blanks, spiked blanks, duplicate and spiked sample every 20 samples, and an EPA known reference sample.

### Analysis of Total Organic Carbon (TOC)

TOC samples are analyzed on a daily basis with the number of samples analyzed per day dependent on the request for duplicate or quadruplicate analyses. The quality control program is designed to maintain the appropriate amount of QC and consists of the following elements:

- Daily instrument calibration
- One blank
- Standard recalibration every 10 samples
- Spiked samples at a low and high level
- Every sample is run in duplicate at a minimum

### Analysis of Total Organic Halide (TOX)

- Blank reagent water for absolute carbon background must contain less than 5 ug/l of halide (as chloride).
- Using a trichlorophenol standard, the mean adsorption efficiency must be within +/- 15% of the standard value.
- Calibration standards are run every 10 samples.
- Every sample is run in duplicate at a minimum.

## Analysis of 2,3,7,8-TCDD (Dioxin) by GC/MS (SIM)

- Each sample is dosed with a known quantity of  $^{13}\text{C}_{12}$ -2,3,7,8-TCDD as internal standard and  $^{37}\text{Cl}_4$ -TCDD as surrogate standard. The action limits for surrogate standard results are  $\pm 40\%$  of the true value. Samples showing surrogate standard results outside of these limits are reextracted and reanalyzed.
- Two laboratory "method blanks" are run along with each set of 24 or fewer samples. The method blank is also dosed with the internal standard and surrogate standard.
- At least one per set of 24 samples is run in duplicate to determine intralaboratory precision.

## Subcontractor QA/QC

Each subcontractor is required to maintain an appropriate level of quality control. To insure this, each subcontractor is required to submit to ETC the quality control data for all analyses it performs. This data is kept on file at ETC. In general, the amount of quality control required is one duplicate sample with one spiked sample for every ten analyses. Subcontract laboratories are audited by ETC QA personnel on a routine basis.

## Chain-of-Custody

The chain-of-custody procedure is part of our quality assurance protocol. We believe our chain-of-custody record fully complies with the legal requirements of federal, state and local government agencies and of the courts of law. The record covers:

- labeling of sample bottles, packing the Sample Shuttle and transferring the Shuttle under seal to the custody of a shipper;
- outgoing shipping manifests;
- the chain-of-custody form completed by the persons(s) breaking the Shuttle seal, taking the sample, resealing the Shuttle and transferring custody to a shipper;
- incoming shipping manifests;
- breaking the Shuttle's reseal;
- storing each labeled sample bottle in a secured area;
- disposition of each sample to an analyst or technician; and
- the use of the sample in each bottle in a testing procedure appropriate to the intended purpose of the sample.

The records show for each link in this process:

- the person with custody; and
- the time and date each person accepted or relinquished custody.

## QA Program

In addition to the procedure requirements for QC samples, ETC's Quality Assurance department has developed a blind QC sample program which involves:

- Monthly blank samples for analytical procedures.
- Bi-monthly spiked samples (blind QC) for each analytical area (GC/MS, GC, AA, Conventional).
- Quarterly refrigerator blank studies, to evaluate background levels.
- Performance evaluation samples consisting of state, federal, contract, and/or client initiated samples

The QA department may also at any time initiate QC performance testing as necessary. These studies may be used to develop detection limits, method validation, and method precision and accuracy.